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# COMMERCIAL GENERATION STUDY PALM BEACH COUNTY, FLORIDA

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May 1993 - February 1995

May 22, 1995



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# Commercial Generation Study Palm Beach County Florida

May 4, 1995

## Table of Contents

|  |    |
|--|----|
| 1.0 Introduction.....  | 1  |
| 1.1 SWA Assessment Program .....                                       | 1  |
| 1.2 Study Design and Methodology .....                                 | 1  |
| 1.2.1 Desired Sample Size.....   | 2  |
| 1.2.3 Percentage of Maximum Container Volume .....                     | 3  |
| 1.2.4 Average Waste Density.....                                       | 3  |
| 1.2.5 Data Compilation .....   | 3  |
| 1.3 Data Review.....   | 4  |
| 1.3.1 Partial Information .....  | 4  |
| 1.3.2 Non-Generators.....  | 4  |
| 1.3.3 Changes in Container Size and Collection Frequency.....          | 4  |
| 1.3.4 Going Out of Business.....                                       | 4  |
| 1.3.5 Shared Containers.....   | 4  |
| 1.3.6 Compactors.....  | 5  |
| 1.3.7 Hospitals with Incinerators.....                                 | 5  |
| 2.0 Data Summary.....  | 6  |
| 2.1 Data Compilation.....  | 6  |
| 2.1.1 Average Percent Full.....  | 6  |
| 2.1.2 Average Density.....   | 6  |
| 2.1.3 Estimated Annual Waste Volume.....                               | 7  |
| 2.1.4 Average Generation Rate .....                                    | 7  |
| 2.2 Summary Statistics .....   | 7  |
| 2.2.1 Sample Size .....  | 7  |
| 2.2.2 Heated Square Feet .....   | 7  |
| 2.2.3 Average Percent Full.....  | 7  |
| 2.2.4 Average Density.....   | 8  |
| 2.2.5 Estimated Annual Volume.....                                     | 8  |
| 3.0 Generation Study Results and Discussion.....                       | 21 |
| 3.1 Mean Generation per SF by PA Code.....                             | 21 |
| 3.2 Category Average Generation Rate .....                             | 21 |
| 3.3 Category Summary and Total Commercial Waste Quantity Estimate..... | 24 |
| 3.4 Category Ranking.....  | 24 |
| 3.5 Defining Class Boundaries.....                                     | 24 |
| 3.6 Changes from Previous Study Results .....                          | 30 |
| 4.0 Summary and Concluding Comments.....                               | 31 |

## **1.0 Introduction**

A twelve month study was undertaken to determine the waste generation characteristics of commercial property in Palm Beach County, FL. This study was required to determine the quantity of commercial solid waste generated and the relative generation rates of various types of commercial property to provide a rational basis for the Solid Waste Authority Annual Commercial Assessment. The bulk of this study was designed and conducted by the Solid Waste Authority from May 1993 through April 1994. The last commercial generation study was completed in April 1991 and prepared by DUS Consultants.

### **1.1 SWA Assessment Program**

The SWA assesses the residents and businesses of Palm Beach County for the cost of solid waste disposal on an annual basis on the property tax bill. Currently the SWA assesses residences for 100% of the annual disposal cost and assesses commercial property for approximately 50% of the annual cost of disposal, the balance being paid through tipping fees.

There are 54 classifications or types of commercial property differentiated by PA code designation. These PA codes are grouped into three categories consisting of low, medium, and high generators. The annual commercial assessment is calculated by multiplying the commercial assessment for the category times the total heated square footage of property. The assessment is driven by the average waste generation per heated square foot of commercial property. The waste generation study is designed to estimate, based on a sampling procedure, the average generation in pounds per square foot of property.

### **1.2 Study Design and Methodology**

In order to calculate the average pounds per square foot of commercial property, three variables were required. These variables included the level of service for each business unit in terms of container size and number of container dumps per week, the average quantity of waste in the container at the time of collection expressed as a percentage of maximum container volume, and the average density of waste in the container specified in pounds per cubic yard.

#### **1.2.1 Desired Sample Size**

A schedule of the number of commercial entities by PA code (business type) was provided by SWA Customer Information Services based on the commercial tax roll. A goal of a 10% sample size for each PA code was established. The target population for the data collection is defined as all commercial property in Palm Beach County. The sample population was confined to commercial parcels containing only one business entity (single unit parcels) because of the difficulty in apportioning generation to specific businesses when they share a container.

The selection process was largely non-random, however waste generation characteristics were not a determining factor when selecting one parcel over another. The primary factors that resulted in a parcel not being considered were multi-unit parcels and the existence of unique collection methodologies which could pose operational problems, such as rear-load dumpsters which could not be weighed. There is no reason to believe that the statistical properties of the sample differ from the population as a result of the above restrictions.

### 1.2.2 Level Of Service

In order to determine the service level for each business unit, CIS contacted each commercial entity in the commercial sample to determine the size of their container and the number of times per week it was serviced. The responses were cross-checked with data provided by the hauler to ensure maximum accuracy.

### 1.2.3 Percentage of Maximum Container Volume

Using the container size and weekly services to determine generation would overstate generation because the container isn't always full. In order to solve this problem, each container was visited once per month just prior to the scheduled collection time to determine the percent full. CIS personnel measured the container volume and the waste volume to determine the percent full. It was hoped that twelve monthly observations could be taken for each container to allow for the calculation of generation at the parcel level, however, because of difficulty in scheduling and because containers were often reached after being dumped by the hauler, this was not possible.

### 1.2.4 Average Waste Density

The Authority bills based on weight, not volume. Volume measures are converted to weight measures using the average density of commercial waste as a conversion factor. The Authority currently uses an average density of 134 pounds per cubic yard, as was determined in the initial study. Each container was weighed twice using a scale equipped front-end loader collection vehicle, once empty and once with waste in it. The waste volume (% full) was noted when the container was weighed with waste in it. The average density was calculated by subtracting the empty weight from the full weight and dividing by the adjusted volume (size x % full). This procedure proved extremely difficult in the study due to the difficulty in getting to the containers when they were empty. The effort was made easier when a decision was made to actually dump the waste, allowing both weights to be determined at the same time, although at some cost to the Authority.

The only exception to the above procedure was in the case of containers that could not be serviced using a front-end loader, which were primarily smaller plastic garbage cans ranging in size from 13 gallons to 95 gallons. The empty weights were determined by weighing one container of each size at a local home store to determine the empty weight. This procedure was deemed acceptable because the weight of these containers does not vary significantly, while the weight of steel dumpsters of the same size can vary widely due to differences in the gauge of the steel, the configuration, the lid material, and the number and size of welds used to repair or rebuild the container. The weights of the small plastic containers are assumed as follows:

|           |        |           |        |
|-----------|--------|-----------|--------|
| 13 gallon | 3 lbs  | 20 gallon | 4 lbs  |
| 30 gallon | 6 lbs  | 32 gallon | 6 lbs  |
| 35 gallon | 7 lbs  | 40 gallon | 8 lbs  |
| 45 gallon | 10 lbs | 95 gallon | 37 lbs |

### 1.2.5 Data Compilation

All collected data was hand recorded on route sheets and transferred to the Solid Waste Authority computer

system for storage and retrieval.

### **1.3 Data Review**

The study data was reviewed to identify outliers and determine what special circumstances, if any, might unrealistically skew the results. The following is a description of special circumstances or irregularities with the data and the means used to address the potential impact. Other than the decrease in the sample size that resulted from the elimination of some PCN's, the corrective actions highlighted below did not have a material negative impact on the results, but alternatively, these actions resulted in a decrease in the potential for error by preventing the need to make additional assumptions.

#### **1.3.1 Partial Information**

In some circumstances, PCN's selected to be included in the study ultimately were not studied because information on their level of collection was not available. This resulted from a number of reasons, including lack of knowledge on the part of the business owner regarding the frequency of collection, inaccessible containers, special collection requirements, or a combination of the above. In the case where key data was unavailable, these units were eliminated from the study. If a PCN was eliminated from the study due to level of service irregularities but valid waste density or percent container volume data was available, the partial information was used for those components of the study.

#### **1.3.2 Non-Generators**

Fifty units in the study reflected their level of service as being zero, meaning that they did not generate waste. These PCN's represented primarily storage facilities and garages, but also included a t-shirt shop that reuses cardboard boxes to ship orders. These units were left in the study as they represent a legitimate class of non-generators that reduce the average generation rate, the absence of which would inflate the average generation rate. Although the data from these units is obviously limited to the container size and collection frequency and thus cannot be used for average density and average percent container volume calculations, it can and is used to estimate average generation.

#### **1.3.3 Changes in Container Size and Collection Frequency**

As a normal course of business or as a result of a change in ownership, container sizes or collection frequencies changed for some PCN's during the study period. When these changes were noted, a notation was made in the file to reflect said change, however, the data record was not modified. Based upon a review of these notations, the data has been edited to reflect these changes. This editing affected the annual gross generation estimate only.

#### **1.3.4 Going Out of Business**

Several businesses ceased operation during the study, requiring the volume testing to be stopped. For the purpose of the generation estimate, these units have been retained in the study, as has all data collected to the time of the realization that business has ceased. The total estimated generation was adjusted to account for the vacancy through pro-rata.

### 1.3.5 Shared Containers

In some circumstances, several businesses shared a container. In many cases, these businesses were in the same PA code and, rather than eliminate these units from the study, the container was apportioned between the two businesses. For example, if a 4 cubic yard container was shared by two retail stores, it was reflected in the study as two 2 cubic yard containers. For the density calculation, the weights were split between the two PCN's. For the percent full calculation, the observations for the two businesses are the same. This treatment does not impact the results of the study because in all cases weighted average summaries are used as opposed to unweighted averages. In other words, the total generation for the PA code is divided by the total heated square feet for the PA code and neither of these variables is changed by this adjustment.

### 1.3.6 Compactors

Many businesses, particularly larger businesses such as grocery stores and department stores use compactors. Compactor units require a different treatment for several reasons. First, their overall cubic yard generation is skewed because the waste is compacted. Second, the frequency of collection is not specific as most compactors are serviced on an on-call basis. Third, the average density is greater than that for uncompacted waste. The Authority contacted the haulers, provided them with a list of businesses and requested that they provide the total pounds of waste generated from May 1993 to April 1994 for each business. These responses were incorporated into the study when available.

In other cases, the volume of the container was multiplied by a factor of 3 to account for increased compaction. Although compactor density is variable, the recognized industry average is 3-4 times uncompacted waste. Using a 3:1 ratio is conservative, but nonetheless is a potential source of error. In recognition of this, for all PA codes with PCN's receiving compactor service, summary statistics for the compactor units were compared to summary statistics for both the category and the noncompactor units. In cases where a significant difference was noted between the two groups, the compactors and the PCN's were eliminated from the study. The PA codes affected and the number of PCN's eliminated were restaurants(18), fast food restaurants(11), bars/nightclubs(1), garages(1), vehicle sales/repair(1), and clubhouses(1).

### 1.3.7 Hospitals with Incinerators

Subsequent to the initial data collection period, the Authority undertook a study of three hospitals in the county which use incinerators to reduce/dispose of medical and other waste in order to determine if the waste generation characteristics differ significantly from other hospitals. The results of the study indicated that hospitals with incinerators do dispose of less waste and, therefore, these hospitals have been moved to a category of their own. This report incorporates the results of this study. The study was carried out over a four month period and the results annualized using the seasonality ratios presented in the report. The net weight of waste and percentage volume were determined for a one week period in each month for Bethesda and St. Mary's hospitals. Because JFK Hospital uses a compactor, the waste could not be collected and weighed by the Authority. In its place, Authority scale records were used. Since JFK hauls its own waste to the Authority, the truck numbers associated with JFK were used to determine the annual generation over the period from October 1993 to September 1994. The total waste quantity for all three hospitals was divided by the total square footage of all three hospitals to determine the annual generation rate. The net weights and percentage volumes for Bethesda and St. Mary's were used to calculate the average density of waste for the category.

## **2.0 Data Summary**

Each data record is comprised of the PCN number, PA code, container size in cubic yards, frequency of collection in times per week, percent full at time of density calculation, net weight of waste for density calculation, the average density of the waste, a varying number of percent values representing the percent volume of waste in the container, and the heated square footage of the property.

### **2.1 Data Compilation Methodology**

Several options were available to compile the data. The basic procedure was to first multiply the container size times the number of pickups per week times 52 weeks to obtain the annual gross generation. Second, the gross generation was adjusted downward using the average percent full to produce the annual net generation in cubic yards and divided by the heated square feet to determine the net generation in cubic yards per square foot. Because the Authority bills by tonnage, not volume, the result was then multiplied by the calculated density to produce the average pounds per square foot.

#### **2.1.1 Average Percent Full**

Three measures of the average percent full at the time of collection were available from the study: The average of the percent full measures for each PCN, the average of the percent full measures for each PA code, and the average for the entire sample. Due to seasonality and the inconsistency in the number and timing of the percentage readings for each PCN across the study, using the specific values for each PCN would inaccurately predict the adjusted annual generation. Although the average percent full values vary by PA code, this variance is most likely due to random error, rather than any inherent waste generation differences. For these reasons, the average for the entire sample is used.

#### **2.1.2 Average Density**

The average density of the waste can be calculated and applied for each PCN, each PA code, or for the entire study. The previous generation study analysis performed by DUS consultants used a single average density for the entire study. As was alluded to in the DUS study, this methodology is subject to inaccuracies due to the non-homogeneity of the waste stream. Since the Authority bills by weight, not by volume, using such a broad average tends to overcharge generators of large volumes of very light material and undercharge generators of heavier material. If the Authority ran only a landfill, charging generators of high volume light material more could be justified as landfill cost is driven by volume, not weight. Due to the fact that the Authority's landfill cost is such a small component of its total cost and that very little raw waste is landfilled without being subject to incineration first, the cost of which is based on weight, the tonnage measure is more valid and differential densities are more critical.

On the other hand, due to the difficulty and the cost of obtaining density measures in the field, only one density measure was calculated for each PCN for which a density measure was obtained. Therefore, the sample size is insufficient to draw a valid conclusion about the average density for individual businesses. As a compromise, the results of this study are based on using the calculated weighted average density for each PA code. This average density is calculated by dividing the total net weight of waste for the PA code by the total net volume of waste for the PA code. The results of this calculation are presented in Section 2.2.4.

### 2.1.3 Estimated Annual Waste Volume

The total estimated annual volume for the population sample is calculated by multiplying the container size by the frequency of collection per week, month, or year, whichever the case may be, and again by the number of periods in a year. The individual PCN annual volume estimates are then aggregated at the PA code level. The only variation from the above is in the case of compactor units. The annual generation of businesses that use compactors is difficult to determine because most compactors are serviced on an on-call basis, the density is significantly higher than that for uncompacted waste, and the quantity of waste in the container is impossible to determine without weighing them. In order to accommodate the compactors, the Authority contacted the haulers to obtain information on the pounds of waste collected during the study period from compactor units. For those compactors for which information was available, the weight of the waste was divided by the average density for the PA code to determine the average volume. The volume was divided by the container size to determine the frequency of collection, and the data record was modified to reflect the calculated container volume and frequency. In most instances, a full year of data was not available, therefore the quantity was annualized using seasonality factors for garbage and trash derived from the Authority's weigh station scale data for the last three years. These seasonality factors are in the schedule entitled *Calculated Seasonality Ratios* on Page 20. For additional information concerning the treatment of compactor units, see Section 1.3.6.

### 2.1.4 Average Generation Rate

The average generation rates per square foot for each PA code can be calculated by taking an unweighted average of the average generation rates for each PCN or by using a weighted average for the PA code. In the original study, DUS Consultants demonstrated an inverse relationship between the heated square feet and the waste generation per square foot. Because larger businesses generate larger quantities of waste yet on a smaller per square foot average, using a straight average would tend to skew the average generation rate toward the high end, most adversely affecting the larger businesses. The weighted average more accurately predicts aggregate generation and therefore is the better measure.

## 2.2 Summary Statistics

This section presents the summary statistics used to calculate the average generation rates per square foot of commercial property and the total estimated generation of commercial solid waste which are presented in Section 3 of the report.

### 2.2.1 Sample Size

The total number of businesses ultimately remaining in the study amounted to 1,691, as can be seen in the schedule on [Page 9](#) along with a comparison to the desired goal. The overall sample size amounted to 8.50%. Insufficient data was available for parking structures or aircraft hangars to evaluate their generation habits at this time, therefore, the generation rates reflected in the report are those determined in the previous study. Coincidentally, both of these categories consist primarily of government owned facilities, which, as all other governmental generators, are assessed based on their actual generation.

Due to the limitations highlighted in Section 1.2, and the relatively small size of some PA codes, the sample



size for some PA codes is smaller than would optimally be preferred. This problem is mitigated somewhat through the natural combination of several PA codes into one. For example, only one regional shopping center was sampled, however there are three other categories of shopping centers, neighborhood shopping centers, community shopping centers, and super-regional shopping centers. Although the property appraiser makes a distinction between the four shopping centers, this distinction is not based on solid waste generation characteristics. Due to similar solid waste generation characteristics, their combination is reasonable and consistent with the 1991 methodology. Nonetheless, the small samples in several PA codes are a potential source of error.

### 2.2.2 Heated Square Feet

The properties in the study include a total of 24,374,266 square feet which amounts to 14.62% of the 166,663,219 square feet of commercial property in Palm Beach County (Source: 1994/1995 Assessment Program). A breakdown of the square footage by PA code is presented on Pages 10 and 11 of the report.

### 2.2.3 Average Percent Full

A total of 15,371 observations were made on 1,501 containers, an average of 10.24 observations per container. The distribution of the observations is as follows:

|           |       |              |             |
|-----------|-------|--------------|-------------|
| May       | 1,423 | Observations | 79.72% Full |
| June      | 1,428 | Observations | 82.87% Full |
| July      | 1,422 | Observations | 85.81% Full |
| August    | 986   | Observations | 88.63% Full |
| September | 1,484 | Observations | 79.61% Full |
| October   | 1,486 | Observations | 79.75% Full |
| November  | 1,332 | Observations | 71.71% Full |
| December  | 1,281 | Observations | 74.30% Full |
| January   | 1,164 | Observations | 78.49% Full |
| February  | 1,261 | Observations | 82.81% Full |
| March     | 1,009 | Observations | 83.50% Full |
| April     | 1,095 | Observations | 82.14% Full |

Taking an average of the monthly averages to account for seasonality and negate the impact of varying numbers of observations on the result, the average quantity of waste in the containers just prior to collection is estimated at 80.78%. Had an average of all observations been used rather than the above, the result would not have been significantly different (80.57%), although it would be skewed by the varying number of monthly observations. The average percent full did vary for different PA codes, however, there is no reason to believe that it is the result of anything other than random error. For this reason, the average percent full for the entire sample is used in all calculations. Nonetheless, the PA code average values are provided on Pages 12 and 13.

### 2.2.4 Average Density

The average density of the tested waste is estimated at 159.02 pounds per cubic yard. This is based on a net volume of 3,059.31 cubic yards weighing 486,490 pounds. The calculated average density for each individual

PA code is presented on Pages 14 and 15 in the table called *Average Density by PA Code* and the calculation of the weighted average density for all commercial waste is depicted on Pages 16 and 17 in the tables entitled *Weighted Average Solid Waste Density*.

Applying the estimated volume per square foot from the study to the commercial square footage for each PA code used in the 1994/95 assessment program, the weighted average density has been calculated and is 157.94 pounds per cubic yard. Since the latter value is calculated using the actual proportional countywide square footage rather than the proportions from the study, it is a superior estimate.

The Authority uses the average density in its governmental billing and in its franchise collection agreements. In these applications, the average density is multiplied by the container size to calculate the estimated weight for billing purposes. Because containers are on average 80.78% full at the time of collection, this calculation would overstate the weight of the waste if the calculated average density from this study were used in the calculation. The average density determined from this study must first be adjusted to account for the empty container volume by multiplying the average density by the average percent full.

As described previously, the average percent full was determined by sampling the containers in the study just prior to collection on their collection day. Although efforts were made to minimize the time between measurement and collection, this procedure has the potential of erring on the low side due to the possibility of more waste being added during the short time period between measurement and collection, while quite obviously, no waste would be removed. In order to account for the operational realities, it is recommended that a time allowance factor be added to the average percent full for governmental billing and franchise collection agreement purposes. Although the exact amount is impossible to estimate, an increase of 4% to 85% is reasonable. Based on this value, the average commercial density for governmental billing and franchise collection purposes would be 134.25 pounds per cubic yard (round to 134), which, coincidentally, is the same result determined in the previous study.

Again, for the purpose of calculating the average generation rates for each PA code, the PA code average densities are used, as this most accurately depicts the relative generation rates by PA code as a weight measure.

#### 2.2.5 Estimated Annual Volume

The annual volume by PA code for the sample is presented on Pages 18 and 19 of the study in the table called *Annual Volume by PA Code*. The total estimated annual volume of the PCN's in the study is 894,291 cubic yards prior to adjustments to account for vacancies, level of service changes, and empty container volume. After adjustment for vacancies and level of service changes, the annual volume for the PCN's in the study was 892,680 cubic yards.

[Continued on Page 21]

**1993 Commercial Generation Study**  
**Sample Size and Tested Units by PA Code**

|                                   | Single-Card<br>Parcels | Multi-Card<br>Parcels | Total<br>Buildings | Ten Percent<br>Sample | Proposed<br>Sample | Actual<br>Sample | Sample<br>Percent |
|-----------------------------------|------------------------|-----------------------|--------------------|-----------------------|--------------------|------------------|-------------------|
| 17 Dormitory                      | 49                     | 620                   | 669                | 67                    | 49                 | 25               | 3.74%             |
| 34 Strip Store                    | 321                    | 627                   | 948                | 95                    | 95                 | 93               | 9.81%             |
| 35 Retail Shop                    | 723                    | 683                   | 1,406              | 141                   | 141                | 103              | 7.33%             |
| 36 Discount Store                 | 73                     | 110                   | 183                | 18                    | 18                 | 15               | 8.20%             |
| 37 Department Store               | 20                     | 25                    | 45                 | 5                     | 5                  | 20               | 44.44%            |
| 38 Neighborhood Shopping Center   | 5                      | 197                   | 202                | 20                    | 20 *               | 12               | 5.94%             |
| 39 Community Shopping Center      | 2                      | 168                   | 170                | 17                    | 17 *               | 3                | 1.76%             |
| 40 Shopping Center Regional       | 1                      | 1                     | 2                  | 0                     | 2 *                | 2                | 100.00%           |
| 41 Shopping Center Super Regional | 2                      | 5                     | 7                  | 1                     | 5 *                | 2                | 28.57%            |
| 42 Supermarket                    | 32                     | 137                   | 169                | 17                    | 17                 | 31               | 18.34%            |
| 43 Convenience Store              | 249                    | 179                   | 428                | 43                    | 43                 | 49               | 11.45%            |
| 44 Hotel                          | 9                      | 11                    | 20                 | 2                     | 5                  | 6                | 30.00%            |
| 45 Hotel/Motel/Resort             | 236                    | 61                    | 297                | 30                    | 30                 | 10               | 3.37%             |
| 46 Low Rise Motel                 | 75                     | 300                   | 375                | 38                    | 38                 | 61               | 16.27%            |
| 47 High Rise Motel                | 2                      | 35                    | 37                 | 4                     | 5 *                | 4                | 10.81%            |
| 49 Office-Low Rise                | 1,195                  | 1,348                 | 2,543              | 254                   | 254                | 209              | 8.22%             |
| 50 Office-High Rise               | 26                     | 45                    | 71                 | 7                     | 7                  | 7                | 9.86%             |
| 51 Office Condo                   | 154                    | 4                     | 158                | 16                    | 16                 | 0                | 0.00%             |
| 52 Medical Office                 | 332                    | 137                   | 469                | 47                    | 47                 | 43               | 9.17%             |
| 53 Hospital                       | 4                      | 60                    | 64                 | 6                     | 6 *                | 5                | 7.81%             |
| 5301 Hospitals with Incinerators  |                        |                       |                    |                       |                    | 3                | 4.69%             |
| 54 Nursing Home                   | 21                     | 129                   | 150                | 15                    | 15                 | 22               | 14.67%            |
| 55 Bar/Nightclub                  | 87                     | 168                   | 255                | 26                    | 26                 | 18               | 7.06%             |
| 56 Restaurant                     | 286                    | 1,591                 | 1,877              | 188                   | 188                | 151              | 8.04%             |
| 57 Fast Food Restaurant           | 190                    | 166                   | 356                | 36                    | 36                 | 27               | 7.58%             |
| 58 Bowling Alley                  | 6                      | 9                     | 15                 | 2                     | 5                  | 5                | 33.33%            |
| 59 Arena                          | 6                      | 30                    | 36                 | 4                     | 5                  | 6                | 16.67%            |
| 60 Auditorium                     | 3                      | 24                    | 27                 | 3                     | 5 *                | 2                | 7.41%             |
| 61 Theater                        | 5                      | 28                    | 33                 | 3                     | 5                  | 3                | 9.09%             |
| 62 Bank                           | 66                     | 31                    | 97                 | 10                    | 10                 | 10               | 10.31%            |
| 63 Branch Bank                    | 159                    | 74                    | 233                | 23                    | 23                 | 17               | 7.30%             |
| 64 Service Station                | 226                    | 45                    | 271                | 27                    | 27                 | 15               | 5.54%             |
| 65 Garage                         | 33                     | 70                    | 103                | 10                    | 10                 | 7                | 6.80%             |
| 66 Vehicle Sales/Repair           | 418                    | 425                   | 843                | 84                    | 84                 | 78               | 9.25%             |
| 67 Service Shop                   | 119                    | 144                   | 263                | 26                    | 26                 | 31               | 11.79%            |
| 68 Mortuary                       | 19                     | 31                    | 50                 | 5                     | 5                  | 5                | 10.00%            |
| 69 Clubhouse                      | 394                    | 523                   | 917                | 92                    | 92                 | 62               | 6.76%             |
| 70 Cold Storage/Packaging         | 10                     | 33                    | 43                 | 4                     | 5                  | 5                | 11.63%            |
| 71 Transport Terminal             | 15                     | 14                    | 29                 | 3                     | 5                  | 4                | 13.79%            |
| 72 Parking Structure              | 4                      | 31                    | 35                 | 4                     | 5 *                | 0                | 0.00%             |
| 73 Nursery/Daycare                | 116                    | 56                    | 172                | 17                    | 17                 | 21               | 12.21%            |
| 75 Auto Sales/Service             | 100                    | 89                    | 189                | 19                    | 19                 | 14               | 7.41%             |
| 77 Exceptional Office             | 1                      | 0                     | 1                  | 0                     | 1                  | 0                | 0.00%             |
| 80 Light Manufacturing            | 269                    | 212                   | 481                | 48                    | 48                 | 40               | 8.32%             |
| 81 Heavy Manufacturing            | 1                      | 23                    | 24                 | 2                     | 5 *                | 1                | 4.17%             |
| 82 Distribution Warehouse         | 111                    | 60                    | 171                | 17                    | 17                 | 15               | 8.77%             |
| 83 Mini Warehouse                 | 10                     | 364                   | 374                | 37                    | 10                 | 22               | 5.88%             |
| 84 Warehouse                      | 1,537                  | 1,584                 | 3,121              | 312                   | 312                | 288              | 9.23%             |
| 85 Aircraft Hangar                | 0                      | 6                     | 6                  | 1                     | 5 *                | 0                | 0.00%             |
| 86 Barns                          | 23                     | 169                   | 192                | 19                    | 19                 | 4                | 2.08%             |
| 87 Pre-Fab Metal Building         | 6                      | 13                    | 19                 | 2                     | 5                  | 2                | 10.53%            |
| 88 Technical Manufacturing        | 16                     | 20                    | 36                 | 4                     | 5                  | 3                | 8.33%             |
| 90 School                         | 17                     | 12                    | 29                 | 3                     | 5                  | 4                | 13.79%            |
| 91 Churches                       | 257                    | 299                   | 556                | 56                    | 56                 | 52               | 9.35%             |
| 92 Educational/Religious          | 85                     | 531                   | 616                | 62                    | 62                 | 54               | 8.77%             |
|                                   | 8,126                  | 11,757                | 19,883             | 1,992                 | 1,983              | 1,691            | 8.50%             |

**Criteria for Sample Size Determination**

1. For ease of testing only single card parcels will be tested.
2. A ten percent sample is desirable.
3. If a ten percent sample exceeds the number of single card parcels, all single card parcels will be tested.
4. The minimum sample size for each PA code is 5 unless the number of units in the PA code is less than 5.
5. In cases of an insufficient sample size (\*), multi-card parcels may have been included.
6. Hospital with incinerator category created subsequent to study due to differences in generation characteristics.

## Heated Area by PA Code

| PA Code | Number of PCNs | Heated Sq. Feet |
|---------|----------------|-----------------|
| 1700    | 25             | 131,258         |
| 3400    | 93             | 849,936         |
| 3500    | 103            | 399,048         |
| 3600    | 15             | 629,500         |
| 3700    | 20             | 2,933,911       |
| 3800    | 12             | 383,026         |
| 3900    | 3              | 132,709         |
| 4000    | 2              | 257,549         |
| 4100    | 2              | 1,068,601       |
| 4200    | 31             | 492,623         |
| 4300    | 49             | 92,977          |
| 4400    | 6              | 64,803          |
| 4500    | 10             | 873,768         |
| 4600    | 61             | 578,360         |
| 4700    | 4              | 277,956         |
| 4900    | 209            | 2,839,501       |
| 5000    | 7              | 443,768         |
| 5200    | 43             | 321,814         |
| 5300    | 5              | 697,549         |
| 5301    | 3              | 1,131,326       |
| 5400    | 22             | 716,364         |
| 5500    | 18             | 54,930          |
| 5600    | 151            | 629,452         |
| 5700    | 27             | 74,134          |
| 5800    | 5              | 248,082         |
| 5900    | 6              | 407,944         |
| 6000    | 2              | 17,082          |
| 6100    | 3              | 55,329          |
| 6200    | 10             | 117,827         |
| 6300    | 17             | 78,485          |
| 6400    | 15             | 24,472          |
| 6500    | 7              | 22,886          |
| 6600    | 78             | 379,319         |
| 6700    | 31             | 112,231         |
| 6800    | 5              | 35,509          |
| 6900    | 62             | 369,091         |
| 7000    | 5              | 24,958          |

| PA Code | Number of PCNs | Heated Sq. Feet   |
|---------|----------------|-------------------|
| 7100    | 4              | 13,339            |
| 7300    | 21             | 101,731           |
| 7500    | 14             | 133,144           |
| 8000    | 40             | 506,540           |
| 8100    | 1              | 13,715            |
| 8200    | 15             | 589,745           |
| 8300    | 21             | 863,087           |
| 8301    | 1              | 62,040            |
| 8400    | 288            | 2,945,424         |
| 8600    | 4              | 52,099            |
| 8700    | 2              | 6,942             |
| 8800    | 3              | 174,311           |
| 9000    | 4              | 17,180            |
| 9100    | 52             | 416,285           |
| 9200    | 54             | 510,606           |
|         | <b>1,691</b>   | <b>24,374,266</b> |

## Average Percent Full by PA Code

| PA   | Observations | Sum of % Full | Average % Full |
|------|--------------|---------------|----------------|
| 1700 | 127          | 10,304        | 81.13          |
| 3400 | 1,151        | 91,402        | 79.41          |
| 3500 | 1,121        | 93,283        | 83.21          |
| 3600 | 106          | 8,871         | 83.69          |
| 3700 | 20           | 1,532         | 76.60          |
| 3800 | 462          | 38,284        | 82.87          |
| 3900 | 94           | 7,746         | 82.40          |
| 4000 | 82           | 7,526         | 91.78          |
| 4200 | 243          | 21,604        | 88.91          |
| 4300 | 497          | 43,125        | 86.77          |
| 4400 | 52           | 4,536         | 87.23          |
| 4500 | 28           | 1,943         | 69.39          |
| 4600 | 305          | 23,141        | 75.87          |
| 4700 | 23           | 2,106         | 91.57          |
| 4900 | 2,012        | 153,745       | 76.41          |
| 5000 | 89           | 7,191         | 80.80          |
| 5100 | 47           | 3,792         | 80.68          |
| 5200 | 361          | 28,243        | 78.24          |
| 5300 | 32           | 2,892         | 90.38          |
| 5301 | 11           | 1,001         | 91.00          |
| 5400 | 73           | 5,801         | 79.47          |
| 5500 | 186          | 15,744        | 84.65          |
| 5600 | 1,557        | 130,103       | 83.56          |
| 5700 | 281          | 22,992        | 81.82          |
| 5800 | 14           | 992           | 70.86          |
| 5900 | 58           | 4,523         | 77.98          |
| 6000 | 6            | 527           | 87.83          |
| 6100 | 17           | 1,462         | 86.00          |

| PA                   | Observations  | Sum of % Full    | Average % Full |
|----------------------|---------------|------------------|----------------|
| 6200                 | 103           | 7,461            | 72.44          |
| 6300                 | 163           | 11,993           | 73.58          |
| 6400                 | 146           | 12,306           | 84.29          |
| 6500                 | 58            | 4,276            | 73.72          |
| 6600                 | 774           | 63,815           | 82.45          |
| 6700                 | 280           | 23,707           | 84.67          |
| 6800                 | 51            | 3,566            | 69.92          |
| 6900                 | 442           | 32,888           | 74.41          |
| 7000                 | 42            | 3,595            | 85.60          |
| 7100                 | 21            | 1,826            | 86.95          |
| 7300                 | 183           | 14,789           | 80.81          |
| 7500                 | 93            | 7,564            | 81.33          |
| 8000                 | 359           | 29,790           | 82.98          |
| 8200                 | 128           | 10,368           | 81.00          |
| 8300                 | 69            | 5,564            | 80.64          |
| 8301                 | 9             | 691              | 76.78          |
| 8400                 | 2,664         | 215,294          | 80.82          |
| 8600                 | 14            | 955              | 68.21          |
| 8700                 | 12            | 1,077            | 89.75          |
| 8800                 | 47            | 3,340            | 71.06          |
| 9000                 | 22            | 1,782            | 81.00          |
| 9100                 | 262           | 18,197           | 69.45          |
| 9200                 | 374           | 29,262           | 78.24          |
| <b>Grand Total :</b> | <b>15,371</b> | <b>1,238,517</b> | <b>80.57</b>   |

## Average Density by PA Code

| PA Code | Net Volume | Net Weight | Average Density |
|---------|------------|------------|-----------------|
| 1700    | 30.81      | 4,770      | 154.82          |
| 3400    | 210.02     | 29,288     | 139.45          |
| 3500    | 165.21     | 25,899     | 156.77          |
| 3600    | 32.78      | 3,820      | 116.53          |
| 3700    | 2.90       | 320        | 110.34          |
| 3800    | 85.78      | 14,630     | 170.55          |
| 3900    | 11.86      | 1,790      | 150.93          |
| 4000    | 11.10      | 2,540      | 228.83          |
| 4200    | 55.32      | 9,998      | 180.74          |
| 4300    | 119.65     | 14,705     | 122.90          |
| 4400    | 6.08       | 1,260      | 207.38          |
| 4500    | 17.96      | 1,717      | 95.61           |
| 4600    | 33.37      | 6,674      | 199.97          |
| 4700    | 3.40       | 460        | 135.29          |
| 4900    | 334.25     | 39,355     | 117.74          |
| 5000    | 16.44      | 2,010      | 122.26          |
| 5100    | 16.64      | 3,350      | 201.32          |
| 5200    | 68.89      | 7,918      | 114.94          |
| 5300    | 13.42      | 2,140      | 159.46          |
| 5301    | 13.12      | 2,260      | 172.26          |
| 5400    | 41.33      | 4,956      | 119.91          |
| 5500    | 34.59      | 5,330      | 154.09          |
| 5600    | 381.89     | 72,929     | 190.97          |
| 5700    | 93.65      | 19,010     | 202.99          |
| 5800    | 7.63       | 690        | 90.43           |
| 5900    | 21.19      | 4,910      | 231.71          |
| 6000    | 0.22       | 21         | 94.25           |
| 6100    | 2.00       | 490        | 245.00          |
| 6200    | 14.89      | 1,210      | 81.26           |
| 6300    | 20.91      | 3,051      | 145.92          |



| PA Code              | Net Volume      | Net Weight     | Average Density |
|----------------------|-----------------|----------------|-----------------|
| 6400                 | 21.77           | 3,715          | 170.66          |
| 6500                 | 7.53            | 1,327          | 176.16          |
| 6600                 | 126.24          | 23,006         | 182.24          |
| 6700                 | 39.34           | 6,230          | 158.38          |
| 6800                 | 8.10            | 930            | 114.81          |
| 6900                 | 67.76           | 9,822          | 144.96          |
| 7000                 | 19.56           | 1,750          | 89.47           |
| 7100                 | 3.22            | 240            | 74.53           |
| 7300                 | 27.35           | 4,696          | 171.73          |
| 7500                 | 20.75           | 2,506          | 120.76          |
| 8000                 | 68.34           | 13,735         | 200.97          |
| 8100                 | 0.24            | 40             | 166.67          |
| 8200                 | 47.14           | 6,180          | 131.10          |
| 8300                 | 28.04           | 5,079          | 181.11          |
| 8301                 | 2.34            | 280            | 119.66          |
| 8400                 | 568.79          | 101,405        | 178.28          |
| 8600                 | 8.89            | 1,410          | 158.55          |
| 8700                 | 0.40            | 60             | 150.00          |
| 8800                 | 16.85           | 2,370          | 140.65          |
| 9000                 | 6.23            | 1,139          | 182.90          |
| 9100                 | 37.52           | 3,541          | 94.38           |
| 9200                 | 65.60           | 9,528          | 145.23          |
| <b>Grand Total :</b> | <b>3,059.31</b> | <b>486,490</b> | <b>159.02</b>   |

**1993 Commercial Generation Study  
Weighted Average Solid Waste Density**

|                                     | Total<br>Tested<br>SF | Total<br>Tested<br>Volume | Average<br>Volume<br>per SF | Total<br>Heated<br>SF | Total<br>Estimated<br>Volume | Estimated<br>Average<br>Density | Weighted<br>Average<br>Density |
|-------------------------------------|-----------------------|---------------------------|-----------------------------|-----------------------|------------------------------|---------------------------------|--------------------------------|
| 1700 Dormitory                      | 131,258               | 8,502                     | 0.06                        | 1,546,802             | 100,191                      | 154.82                          | 2.20                           |
| 3400 Strip Store                    | 849,936               | 30,175                    | 0.04                        | 8,561,805             | 303,967                      | 139.45                          | 6.02                           |
| 3500 Retail Shop                    | 399,048               | 23,554                    | 0.06                        | 4,656,096             | 274,831                      | 156.77                          | 6.11                           |
| 3600 Discount Store                 | 629,500               | 32,896                    | 0.05                        | 7,054,986             | 368,675                      | 116.53                          | 6.10                           |
| 3700 Department Store               | 2,933,911             | 56,735                    | 0.02                        | 4,349,126             | 84,102                       | 110.34                          | 1.32                           |
| 3800 Neighborhood Shopping Center   | 383,026               | 18,304                    | 0.05                        | 3,805,623             | 181,863                      | 170.55                          | 4.40                           |
| 3900 Community Shopping Center      | 132,709               | 3,328                     | 0.03                        | 3,024,990             | 75,859                       | 150.93                          | 1.62                           |
| 4000 Shopping Center Regional       | 257,549               | 8,632                     | 0.03                        | 260,413               | 8,728                        | 228.83                          | 0.28                           |
| 4100 Shopping Center Super Regional | 1,068,601             | 50,700                    | 0.05                        | 1,851,427             | 87,841                       | 174.36                          | 2.17                           |
| 4200 Supermarket                    | 492,623               | 55,156                    | 0.11                        | 4,134,531             | 462,921                      | 180.74                          | 11.87                          |
| 4300 Convenience Store              | 92,977                | 19,980                    | 0.21                        | 739,287               | 158,867                      | 122.90                          | 2.77                           |
| 4400 Hotel                          | 64,803                | 3,163                     | 0.05                        | 499,730               | 24,393                       | 207.38                          | 0.72                           |
| 4500 Hotel/Motel/Resort             | 873,768               | 28,931                    | 0.03                        | 1,109,648             | 36,741                       | 95.61                           | 0.50                           |
| 4600 Low Rise Motel                 | 578,360               | 18,056                    | 0.03                        | 4,076,367             | 127,261                      | 199.97                          | 3.61                           |
| 4700 High Rise Motel                | 277,956               | 8,320                     | 0.03                        | 3,096,800             | 92,696                       | 135.29                          | 1.78                           |
| 4900 Office-Low Rise                | 2,839,501             | 82,251                    | 0.03                        | 24,334,952            | 704,907                      | 117.74                          | 11.78                          |
| 5000 Office-High Rise               | 443,768               | 7,072                     | 0.02                        | 6,186,121             | 98,584                       | 122.26                          | 1.71                           |
| 5100 Office Condo                   | 0                     | 0                         | 0.03                        | 3,960,661             | 104,267                      | 118.30                          | 1.75                           |
| 5200 Medical Office                 | 321,814               | 10,284                    | 0.03                        | 3,000,050             | 95,873                       | 114.94                          | 1.56                           |
| 5300 Hospital                       | 697,549               | 19,600                    | 0.03                        | 2,084,563             | 58,573                       | 159.46                          | 1.33                           |
| 5301 Hospitals with Incinerators    | 1,131,326             | 10,697                    | 0.01                        | 1,150,848             | 10,882                       | 172.26                          | 0.27                           |
| 5400 Nursing Home                   | 716,364               | 16,076                    | 0.02                        | 3,577,707             | 80,287                       | 119.91                          | 1.37                           |
| 5500 Bar/Nightclub                  | 54,930                | 5,460                     | 0.10                        | 729,894               | 72,551                       | 154.09                          | 1.59                           |
| 5600 Restaurant                     | 629,452               | 104,357                   | 0.17                        | 6,452,720             | 1,069,795                    | 190.97                          | 28.99                          |
| 5700 Fast Food Restaurant           | 74,134                | 18,096                    | 0.24                        | 758,363               | 185,115                      | 202.99                          | 5.33                           |
| 5800 Bowling Alley                  | 248,082               | 6,864                     | 0.03                        | 517,402               | 14,316                       | 90.43                           | 0.18                           |
| 5900 Arena                          | 407,944               | 4,524                     | 0.01                        | 629,811               | 6,984                        | 231.71                          | 0.23                           |
| 6000 Auditorium                     | 17,082                | 439                       | 0.03                        | 648,148               | 16,664                       | 94.25                           | 0.22                           |
| 6100 Theater                        | 55,329                | 2,366                     | 0.04                        | 745,758               | 31,890                       | 249.00                          | 1.11                           |
| 6200 Bank                           | 117,827               | 2,392                     | 0.02                        | 989,031               | 20,078                       | 81.26                           | 0.23                           |
| 6300 Branch Bank                    | 78,485                | 4,138                     | 0.05                        | 797,407               | 42,046                       | 145.92                          | 0.87                           |
| 6400 Service Station                | 24,472                | 2,878                     | 0.12                        | 352,529               | 41,452                       | 170.66                          | 1.00                           |
| 6500 Garage                         | 22,886                | 1,063                     | 0.05                        | 247,977               | 11,520                       | 176.16                          | 0.29                           |
| 6600 Vehicle Sales/Repair           | 379,319               | 16,832                    | 0.04                        | 3,660,377             | 162,428                      | 182.24                          | 4.20                           |
| 6700 Service Shop                   | 112,231               | 5,914                     | 0.05                        | 1,008,578             | 53,146                       | 158.38                          | 1.19                           |
| 6800 Mortuary                       | 35,509                | 728                       | 0.02                        | 232,410               | 4,765                        | 114.81                          | 0.08                           |
| 6900 Clubhouse                      | 369,091               | 15,337                    | 0.04                        | 4,567,293             | 189,788                      | 144.96                          | 3.90                           |
| 7000 Cold Storage/Packaging         | 24,958                | 4,608                     | 0.18                        | 279,384               | 51,583                       | 89.47                           | 0.65                           |
| 7100 Transport Terminal             | 13,339                | 464                       | 0.03                        | 20,866                | 726                          | 74.53                           | 0.01                           |
| 7200 Parking Structure              |                       |                           |                             |                       |                              | 0.00                            | 0.00                           |
| 7400 Gas Mart                       | 0                     | 0                         | 0.12                        | 36,987                | 4,349                        | 170.66                          | 0.11                           |
| 7300 Nursery/Daycare                | 101,731               | 4,128                     | 0.04                        | 865,215               | 35,105                       | 171.73                          | 0.86                           |
| 7500 Auto Sales/Service             | 133,144               | 5,257                     | 0.04                        | 1,428,107             | 56,384                       | 120.76                          | 0.97                           |
| 7700 Exceptional Office             |                       |                           |                             |                       |                              | 0.00                            | 0.00                           |
| 8000 Light Manufacturing            | 506,540               | 14,292                    | 0.03                        | 5,545,571             | 156,472                      | 200.97                          | 4.46                           |
| 8100 Heavy Manufacturing            | 13,715                | 936                       | 0.07                        | 234,580               | 16,009                       | 166.67                          | 0.38                           |
| 8200 Distribution Warehouse         | 589,745               | 12,544                    | 0.02                        | 4,030,792             | 85,736                       | 131.10                          | 1.60                           |
| 8300 Mini Warehouse                 | 925,127               | 11,867                    | 0.01                        | 3,647,311             | 46,785                       | 176.40                          | 1.17                           |
| 8400 Warehouse                      | 2,945,424             | 106,278                   | 0.04                        | 24,439,218            | 881,823                      | 178.28                          | 22.31                          |
| 8500 Aircraft Hangar                |                       |                           |                             |                       |                              | 0.00                            | 0.00                           |
| 8600 Barns                          | 52,099                | 2,104                     | 0.04                        | 304,336               | 12,291                       | 158.55                          | 0.28                           |
| 8700 Pre-Fab Metal Building         | 6,942                 | 328                       | 0.05                        | 35,368                | 1,671                        | 150.00                          | 0.04                           |
| 8800 Technical Manufacturing        | 174,311               | 3,412                     | 0.02                        | 2,463,657             | 48,224                       | 140.65                          | 0.96                           |
| 9000 School                         | 17,180                | 893                       | 0.05                        | 122,542               | 6,368                        | 182.90                          | 0.17                           |
| 9100 Churches                       | 416,285               | 5,638                     | 0.01                        | 3,533,614             | 47,862                       | 94.38                           | 0.64                           |
| 9200 Educational/Religious          | 510,606               | 16,130                    | 0.03                        | 4,132,947             | 130,556                      | 145.23                          | 2.69                           |
| <b>Total</b>                        | <b>24,374,266</b>     | <b>892,680</b>            |                             | <b>166,520,726</b>    | <b>7,046,792</b>             |                                 | <b>157.94</b>                  |

**Weighted Average Solid Waste Density  
Combined Commercial Categories**

|                                     | 1994<br>Estimated<br>Volume | Measured<br>Net<br>Volume | Measured<br>Net<br>Weight | Calculated<br>Average<br>Density | Weighted<br>Average<br>Density |
|-------------------------------------|-----------------------------|---------------------------|---------------------------|----------------------------------|--------------------------------|
| <b>Shopping Centers</b>             |                             |                           |                           |                                  |                                |
| 3800 Neighborhood Shopping Center   | 181,863                     | 85.78                     | 14,630                    | 170.55                           | 116.41                         |
| 3900 Community Shopping Center      | 75,859                      | 11.86                     | 1,790                     | 150.93                           | 42.97                          |
| 4000 Shopping Center Regional       | 8,728                       | 11.10                     | 2,540                     | 228.83                           | 7.50                           |
| 4100 Shopping Center Super Regional | 87,841                      |                           |                           |                                  |                                |
|                                     | <u>354,291</u>              | <u>108.74</u>             | <u>18,960</u>             | <u>174.36</u>                    | <u>166.87</u>                  |
| <b>Hotel/Motel/Resorts</b>          |                             |                           |                           |                                  |                                |
| 4400 Hotel                          | 24,393                      | 6.08                      | 1,260                     | 207.24                           | 17.98                          |
| 4500 Hotel/Motel/Resort             | 36,741                      | 17.96                     | 1,717                     | 95.60                            | 12.50                          |
| 4600 Low Rise Motel                 | 127,261                     | 33.37                     | 6,674                     | 200.00                           | 90.55                          |
| 4700 High Rise Motel                | 92,696                      | 3.4                       | 460                       | 135.29                           | 44.62                          |
|                                     | <u>281,092</u>              | <u>60.81</u>              | <u>9,651</u>              | <u>158.71</u>                    | <u>165.64</u>                  |
| <b>Offices</b>                      |                             |                           |                           |                                  |                                |
| 4900 Office-Low Rise                | 704,907                     | 334.25                    | 39,355                    | 117.74                           | 103.30                         |
| 5000 Office-High Rise               | 98,584                      | 16.44                     | 2,010                     | 122.26                           | 15.00                          |
| 5100 Office-Condo (2)               | 104,267                     |                           |                           |                                  |                                |
|                                     | <u>907,758</u>              | <u>350.69</u>             | <u>41,365</u>             | <u>117.95</u>                    | <u>118.30</u>                  |

**Notes:**

- (1) When PA codes are grouped together, a weighted average density is used based on the estimated 1994 solid waste volumes.
- (2) Due to the possible inclusion of waste not associated with offices in the office condo results, these results are not used.

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**Annual Volume by PA Code**

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| <b>PA Code</b> | <b>Annual Volume</b> |
|----------------|----------------------|
| 1700           | 8,502.00             |
| 3400           | 30,226.99            |
| 3500           | 23,554.19            |
| 3600           | 32,896.00            |
| 3700           | 56,735.20            |
| 3800           | 18,304.00            |
| 3900           | 3,328.00             |
| 4000           | 8,632.00             |
| 4100           | 50,700.00            |
| 4200           | 55,675.92            |
| 4300           | 20,032.00            |
| 4400           | 3,163.25             |
| 4500           | 28,931.28            |
| 4600           | 18,055.94            |
| 4700           | 8,320.00             |
| 4900           | 82,303.34            |
| 5000           | 7,072.00             |
| 5200           | 10,284.20            |
| 5300           | 19,600.00            |
| 5301           | 10,697.44            |
| 5400           | 16,075.89            |
| 5500           | 5,460.00             |
| 5600           | 105,257.38           |
| 5700           | 18,096.00            |
| 5800           | 6,864.00             |
| 5900           | 4,524.00             |
| 6000           | 439.17               |
| 6100           | 2,366.00             |
| 6200           | 2,392.00             |
| 6300           | 4,138.39             |
| 6400           | 2,877.52             |
| 6500           | 1,063.17             |
| 6600           | 16,866.82            |
| 6700           | 5,913.91             |
| 6800           | 728.00               |
| 6900           | 15,337.10            |

| PA Code | Annual Volume     |
|---------|-------------------|
| 7000    | 4,608.00          |
| 7100    | 464.00            |
| 7300    | 4,127.61          |
| 7500    | 5,256.73          |
| 8000    | 14,292.37         |
| 8100    | 936.00            |
| 8200    | 12,544.00         |
| 8300    | 11,242.82         |
| 8301    | 624.00            |
| 8400    | 106,277.70        |
| 8600    | 2,104.09          |
| 8700    | 328.00            |
| 8800    | 3,412.00          |
| 9000    | 892.78            |
| 9100    | 5,638.45          |
| 9200    | 16,129.63         |
|         | <b>894,291.29</b> |

**Solid Waste Authority of Palm Beach County**  
**Calculated Seasonality Ratios**

|           | Garbage and Trash Tonnage |            |            |              |       |
|-----------|---------------------------|------------|------------|--------------|-------|
|           | FY 90/91                  | FY 91/92   | FY 92/93   | Total        | %     |
| October   | 77,012.24                 | 77,591.80  | 65,627.30  | 220,231.34   | 8.46% |
| November  | 71,177.76                 | 71,530.43  | 66,676.54  | 209,384.73   | 8.04% |
| December  | 71,265.53                 | 75,923.85  | 70,645.59  | 217,834.97   | 8.37% |
| January   | 80,654.01                 | 77,913.82  | 72,011.21  | 230,579.04   | 8.86% |
| February  | 70,897.39                 | 72,313.24  | 66,113.07  | 209,323.70   | 8.04% |
| March     | 75,933.62                 | 78,356.96  | 82,381.86  | 236,672.44   | 9.09% |
| April     | 77,898.71                 | 75,551.10  | 76,462.81  | 229,912.62   | 8.83% |
| May       | 74,352.02                 | 68,228.74  | 67,525.93  | 210,106.69   | 8.07% |
| June      | 65,899.08                 | 75,103.24  | 73,114.91  | 214,117.23   | 8.22% |
| July      | 73,731.53                 | 72,422.63  | 67,815.32  | 213,969.48   | 8.22% |
| August    | 68,245.01                 | 68,309.95  | 70,544.06  | 207,099.02   | 7.95% |
| September | 65,001.63                 | 70,377.79  | 69,196.05  | 204,575.47   | 7.86% |
|           | 872,068.53                | 883,623.55 | 848,114.65 | 2,603,806.73 |       |

**Monthly Ratios**

|           |       |
|-----------|-------|
| October   | 1.01  |
| November  | 0.96  |
| December  | 1.00  |
| January   | 1.06  |
| February  | 0.96  |
| March     | 1.09  |
| April     | 1.06  |
| May       | 0.97  |
| June      | 0.99  |
| July      | 0.99  |
| August    | 0.95  |
| September | 0.94  |
| Sum       | 12.00 |

Source: Solid Waste Authority Waste Statistics; FYEOCM.XLS.

### 3.0 Generation Study Results and Discussion

The summary results presented in Subsection 2.2 are compiled, summarized, and analyzed in this section of the report. The average waste generation rates for each PA code are presented. The codes are then grouped into business categories with similar businesses. Finally, the business categories are separated into low, medium-low, medium, medium-high and high generator categories, and the weighted average generation rates for each of these categories are determined in the same manner they would be in the Annual Commercial Assessment Program.

#### 3.1 Mean Generation per SF by PA Code

The minimum, maximum, mean and standard deviation of the calculated annual commercial waste generation rates (cy/sf) are presented on Pages 22 and 23 in the table entitled *Mean Generation per SF by PA Code*. The mean was calculated by dividing the estimated annual generation for each parcel in every PA code by the heated square feet of the business to determine the parcel generation rate and averaging the resulting generation rates across the PA code. The standard deviation is a measure of the variability of the data about the mean.

Generally speaking, as in the previous study, the standard deviations of the waste generation rates in the study indicate a large variation in waste generation characteristics within PA codes. In many cases, the variation about the mean is greater than the mean itself, which depicts a very large variation. This results from substantial differences in the generation characteristics of similar businesses and highlights the difficulty of using the Property Appraiser's designations alone as a basis for commercial billing for solid waste disposal. The results seem to validate DUS Consultants' conclusion that a 100% Assessment based on the Property Appraiser's designations would not result in rate equity or fairness and indicate that the Authority should continue to use a billing methodology incorporating a volume component.

#### 3.2 Category Average Generation Rate

For the purpose of waste generation rate calculation, the category average waste generation is used. This is calculated by dividing the total estimated weight of the tested waste for each PA code by the total tested heated square feet of property in the PA code. First, the total annual volume of waste (pp. 18-19) and total tested square feet of property (pp. 10-11) are compiled by PA code. Second, the total tested volume is multiplied by the study average percent full of 80.78% to calculate the adjusted average annual volume. Third this value is divided by the heated square feet to determine the adjusted **average volume per sf (p. 25)**. Finally, the annual volume generation rate is multiplied by the PA code average density to produce the estimated **average generation rate in pounds per square foot (p. 26)**.

The category average generation rate was selected over the mean generation rate in Section 3.1 for several reasons. In the majority of cases, the mean generation rate produces a higher generation rate than the latter measure, a finding which is consistent with the results in the previous study. Additionally, when the mean generation rate is aggregated to the total commercial square footage, the resultant total estimated commercial generation is outside the reasonable range. This is primarily the result of the fact that although there is a direct relationship between solid waste generation and square footage, it is not linear but decreases as square footage increases. In other words, although the quantity of waste increases with size, the average generation rate is often lower for larger PCN's than for smaller ones.

## Mean Generation per SF by PA

| PA   | # of PCNs | Minimum | Maximum | Mean  | Standard Dev. |
|------|-----------|---------|---------|-------|---------------|
| 1700 | 25        | 0.000   | 0.270   | 0.076 | 0.053         |
| 3400 | 93        | 0.000   | 0.306   | 0.042 | 0.036         |
| 3500 | 103       | 0.000   | 0.520   | 0.082 | 0.083         |
| 3600 | 15        | 0.014   | 0.155   | 0.043 | 0.034         |
| 3700 | 20        | 0.000   | 0.057   | 0.019 | 0.013         |
| 3800 | 12        | 0.007   | 0.185   | 0.052 | 0.049         |
| 3900 | 3         | 0.015   | 0.077   | 0.039 | 0.033         |
| 4000 | 2         | 0.032   | 0.035   | 0.033 | 0.002         |
| 4100 | 2         | 0.036   | 0.056   | 0.046 | 0.014         |
| 4200 | 31        | 0.012   | 5.673   | 0.303 | 0.999         |
| 4300 | 49        | 0.069   | 0.709   | 0.231 | 0.134         |
| 4400 | 6         | 0.002   | 0.285   | 0.070 | 0.107         |
| 4500 | 10        | 0.016   | 1.387   | 0.181 | 0.425         |
| 4600 | 61        | 0.000   | 0.257   | 0.041 | 0.036         |
| 4700 | 4         | 0.007   | 0.041   | 0.023 | 0.014         |
| 4900 | 209       | 0.004   | 0.802   | 0.053 | 0.083         |
| 5000 | 7         | 0.010   | 0.048   | 0.018 | 0.014         |
| 5200 | 43        | 0.006   | 0.338   | 0.047 | 0.056         |
| 5300 | 5         | 0.015   | 0.054   | 0.031 | 0.015         |
| 5301 | 3         | 0.006   | 0.019   | 0.010 | 0.008         |
| 5400 | 22        | 0.000   | 0.067   | 0.028 | 0.018         |
| 5500 | 18        | 0.036   | 0.347   | 0.125 | 0.086         |
| 5600 | 151       | 0.029   | 1.020   | 0.190 | 0.139         |
| 5700 | 27        | 0.033   | 0.866   | 0.264 | 0.185         |
| 5800 | 5         | 0.021   | 0.040   | 0.027 | 0.008         |
| 5900 | 6         | 0.005   | 0.025   | 0.014 | 0.008         |
| 6000 | 2         | 0.003   | 0.052   | 0.027 | 0.035         |
| 6100 | 3         | 0.013   | 0.080   | 0.055 | 0.037         |
| 6200 | 10        | 0.008   | 0.040   | 0.023 | 0.013         |
| 6300 | 17        | 0.007   | 1.017   | 0.129 | 0.243         |
| 6400 | 15        | 0.039   | 0.348   | 0.133 | 0.086         |
| 6500 | 7         | 0.000   | 0.104   | 0.046 | 0.040         |
| 6600 | 78        | 0.000   | 0.253   | 0.056 | 0.042         |
| 6700 | 31        | 0.000   | 0.499   | 0.074 | 0.095         |
| 6800 | 5         | 0.011   | 0.034   | 0.021 | 0.010         |
| 6900 | 62        | 0.003   | 0.310   | 0.048 | 0.054         |
| 7000 | 5         | 0.054   | 0.613   | 0.197 | 0.235         |



| PA   | # of PCNs | Minimum | Maximum | Mean  | Standard Dev. |
|------|-----------|---------|---------|-------|---------------|
| 7100 | 4         | 0.007   | 0.297   | 0.105 | 0.134         |
| 7300 | 21        | 0.007   | 0.097   | 0.040 | 0.025         |
| 7500 | 14        | 0.000   | 0.635   | 0.080 | 0.161         |
| 8000 | 40        | 0.000   | 0.101   | 0.034 | 0.025         |
| 8100 | 1         | 0.068   | 0.068   | 0.068 |               |
| 8200 | 15        | 0.000   | 0.082   | 0.019 | 0.021         |
| 8300 | 21        | 0.001   | 0.198   | 0.031 | 0.051         |
| 8301 | 1         | 0.010   | 0.010   | 0.010 |               |
| 8400 | 288       | 0.000   | 2.036   | 0.061 | 0.162         |
| 8600 | 4         | 0.012   | 0.361   | 0.100 | 0.174         |
| 8700 | 2         | 0.000   | 0.094   | 0.047 | 0.066         |
| 8800 | 3         | 0.009   | 0.043   | 0.022 | 0.018         |
| 9000 | 4         | 0.017   | 0.139   | 0.057 | 0.056         |
| 9100 | 52        | 0.000   | 0.057   | 0.015 | 0.014         |
| 9200 | 54        | 0.000   | 0.320   | 0.049 | 0.074         |

1,691

Applying equal weights to both small and large businesses, as the mean generation rate calculation does, results in an overestimation of the generation for larger businesses. Additionally, the small sample sizes in many PA codes make using a mean generation rate even more unreliable because it increases the potential of a small PCN with a high generation rate skewing the results.

It must be noted, as previously stated, that because no parking structures or aircraft hangars were tested and no data was available, the generation rates presented are those from the previous study. Additionally, no museums were studied as these were subjected to a special study in 1993/1994 in which it was determined that they should be separated from the educational/religious classification and placed in the low generator category.

### **3.3 Category Summary and Total Commercial Waste Quantity Estimate**

Because the PA codes or business use categories maintained by the Property Appraiser's office are not based on waste generation characteristics, some of the distinctions made in the Property Appraiser's classifications are unnecessary, and therefore have been eliminated. For example, a distinction is made between high rise and low rise office buildings in the Property Appraisers system. For the purpose of the generation study, these two categories have been combined, as there is no reason to believe that an office in a high rise would generate waste any differently if it were relocated to a low rise office building.

The generation study *Category Summary* on Page 27 provides the average generation rate for each business classification, including the combined shopping center category, hotel/motel/resort category, office category, and automobile service category. When the categories are combined, the category ratio in pounds per square foot is based on a weighted average of the PA code generation rates, using the square footage from the *1994/1995 Commercial Assessment Program*. Applying the calculated average generation rates to the total commercial square footage, the total estimated annual commercial generation is 448,557 tons, which amounts to 5.38 pounds per square foot. In the previous study, the total calculated annual generation amounted to 549,296 tons or 6.60 pounds per square foot (DUS Consultants, Table 2-1).

### **3.4 Category Ranking**

Using the average generation rates calculated above, the commercial classifications have been ranked in increasing order of waste generation rate. This ranking is presented on Page 28 in the table titled *Category Ranking*.

### **3.5 Defining Class Boundaries**

The ranked data is then grouped into broader categories for assessment billing purposes. The current assessment program consists of three categories: low, medium, and high generators. Broad categories are used for two reasons. First, the assessment is only intended to represent a base capacity charge to cover fixed system costs, while the variable costs of the system are covered by tipping fees, which charge every individual business based upon the quantity of waste it actually generates. Second, the variability of waste generation rates within business classifications precludes the use of individual business classifications for assessment billing purposes. Although to do so would appear to provide increased accuracy, in reality, it would not.

**1993 Commercial Generation Study  
Average Volume per Square Foot**

| PA          | PA Description                | Total Tested SF | Total Annual Volume | Average Percent Full PA | Average Percent Full Study | Total Adjusted Volume PA % | Total Adjusted Volume Study % | Average Volume per SF PA% | Average Volume per SF Study % |
|-------------|-------------------------------|-----------------|---------------------|-------------------------|----------------------------|----------------------------|-------------------------------|---------------------------|-------------------------------|
| 1700        | Dormitory                     | 131,258         | 8,502.00            | 81.13%                  | 80.78%                     | 6,897.67                   | 6,867.92                      | 0.05                      | <b>0.05</b>                   |
| 3400        | Strip Store                   | 849,936         | 30,175.03           | 79.41%                  | 80.78%                     | 23,961.99                  | 24,375.39                     | 0.03                      | <b>0.03</b>                   |
| 3500        | Retail Shop                   | 399,048         | 23,554.19           | 83.20%                  | 80.78%                     | 19,597.09                  | 19,027.07                     | 0.05                      | <b>0.05</b>                   |
| 3600        | Discount Store                | 629,500         | 32,896.00           | 83.69%                  | 80.78%                     | 27,530.66                  | 26,573.39                     | 0.04                      | <b>0.04</b>                   |
| 3700        | Department Store              | 2,933,911       | 56,735.20           | 76.60%                  | 80.78%                     | 43,459.16                  | 45,830.69                     | 0.01                      | <b>0.02</b>                   |
| 3800        | Neighborhood Shopping Center  | 383,026         | 18,304.00           | 82.87%                  | 80.78%                     | 15,168.52                  | 14,785.97                     | 0.04                      | <b>0.04</b>                   |
| 3900        | Community Shopping Center     | 132,709         | 3,328.00            | 82.40%                  | 80.78%                     | 2,742.27                   | 2,688.36                      | 0.02                      | <b>0.02</b>                   |
| 4000        | Shopping Center Regional      | 257,549         | 8,632.00            | 91.78%                  | 80.78%                     | 7,922.45                   | 6,972.93                      | 0.03                      | <b>0.03</b>                   |
| 4100        | Shopping Center Super Regiona | 1,068,601       | 50,700.00           | 80.57%                  | 80.78%                     | 40,848.99                  | 40,955.46                     | 0.04                      | <b>0.04</b>                   |
| 4200        | Supermarket                   | 492,623         | 55,156.32           | 89.80%                  | 80.78%                     | 49,530.38                  | 44,555.28                     | 0.10                      | <b>0.09</b>                   |
| 4300        | Convenience Store             | 92,977          | 19,980.04           | 87.84%                  | 80.78%                     | 17,550.47                  | 16,139.88                     | 0.19                      | <b>0.17</b>                   |
| 4400        | Hotel                         | 64,803          | 3,163.25            | 87.23%                  | 80.78%                     | 2,759.30                   | 2,555.27                      | 0.04                      | <b>0.04</b>                   |
| 4500        | Hotel/Motel/Resort            | 873,768         | 28,931.28           | 69.39%                  | 80.78%                     | 20,075.42                  | 23,370.69                     | 0.02                      | <b>0.03</b>                   |
| 4600        | Low Rise Motel                | 578,360         | 18,055.94           | 75.87%                  | 80.78%                     | 13,699.04                  | 14,585.59                     | 0.02                      | <b>0.03</b>                   |
| 4700        | High Rise Motel               | 277,956         | 8,320.00            | 91.57%                  | 80.78%                     | 7,618.62                   | 6,720.90                      | 0.03                      | <b>0.02</b>                   |
| 4900        | Office-Low Rise               | 2,839,501       | 82,251.38           | 76.35%                  | 80.78%                     | 62,798.93                  | 66,442.66                     | 0.02                      | <b>0.02</b>                   |
| 5000        | Office-High Rise              | 443,768         | 7,072.00            | 80.80%                  | 80.78%                     | 5,714.18                   | 5,712.76                      | 0.01                      | <b>0.01</b>                   |
| 5100        | Office Condo                  | 0               | 0.00                | 80.68%                  | 80.78%                     | 0.00                       | 0.00                          |                           |                               |
| 5200        | Medical Office                | 321,814         | 10,284.20           | 78.24%                  | 80.78%                     | 8,046.36                   | 8,307.58                      | 0.03                      | <b>0.03</b>                   |
| 5300        | Hospital                      | 697,549         | 19,600.00           | 90.38%                  | 80.78%                     | 17,714.48                  | 15,832.88                     | 0.03                      | <b>0.02</b>                   |
| 5301        | Hospitals with Incinerators   | 1,131,326       | 10,697.44           | 91.00%                  | 80.78%                     | 9,734.67                   | 8,641.39                      | 0.01                      | <b>0.01</b>                   |
| 5400        | Nursing Home                  | 716,364         | 16,075.89           | 79.47%                  | 80.78%                     | 12,775.51                  | 12,986.10                     | 0.02                      | <b>0.02</b>                   |
| 5500        | Bar/Nightclub                 | 54,930          | 5,460.00            | 84.65%                  | 80.78%                     | 4,621.89                   | 4,410.59                      | 0.08                      | <b>0.08</b>                   |
| 5600        | Restaurant                    | 629,452         | 104,356.71          | 83.56%                  | 80.78%                     | 87,200.47                  | 84,299.35                     | 0.14                      | <b>0.13</b>                   |
| 5700        | Fast Food Restaurant          | 74,134          | 18,096.00           | 81.82%                  | 80.78%                     | 14,806.15                  | 14,617.95                     | 0.20                      | <b>0.20</b>                   |
| 5800        | Bowling Alley                 | 248,082         | 6,864.00            | 70.86%                  | 80.78%                     | 4,863.83                   | 5,544.74                      | 0.02                      | <b>0.02</b>                   |
| 5900        | Arena                         | 407,944         | 4,524.00            | 77.98%                  | 80.78%                     | 3,527.82                   | 3,654.49                      | 0.01                      | <b>0.01</b>                   |
| 6000        | Auditorium                    | 17,082          | 439.17              | 87.83%                  | 80.78%                     | 385.72                     | 354.76                        | 0.02                      | <b>0.02</b>                   |
| 6100        | Theater                       | 55,329          | 2,366.00            | 86.00%                  | 80.78%                     | 2,034.76                   | 1,911.25                      | 0.04                      | <b>0.03</b>                   |
| 6200        | Bank                          | 117,827         | 2,392.00            | 72.44%                  | 80.78%                     | 1,732.76                   | 1,932.26                      | 0.01                      | <b>0.02</b>                   |
| 6300        | Branch Bank                   | 78,485          | 4,138.39            | 73.58%                  | 80.78%                     | 3,045.03                   | 3,342.99                      | 0.04                      | <b>0.04</b>                   |
| 6400        | Service Station               | 24,472          | 2,877.52            | 83.49%                  | 80.78%                     | 2,402.44                   | 2,324.46                      | 0.10                      | <b>0.09</b>                   |
| 6500        | Garage                        | 22,886          | 1,063.17            | 73.72%                  | 80.78%                     | 783.77                     | 858.83                        | 0.03                      | <b>0.04</b>                   |
| 6600        | Vehicle Sales/Repair          | 379,319         | 16,832.18           | 82.45%                  | 80.78%                     | 13,878.13                  | 13,597.04                     | 0.04                      | <b>0.04</b>                   |
| 6700        | Service Shop                  | 112,231         | 5,913.91            | 84.67%                  | 80.78%                     | 5,007.31                   | 4,777.26                      | 0.04                      | <b>0.04</b>                   |
| 6800        | Mortuary                      | 35,509          | 728.00              | 69.92%                  | 80.78%                     | 509.02                     | 588.08                        | 0.01                      | <b>0.02</b>                   |
| 6900        | Clubhouse                     | 369,091         | 15,337.10           | 74.41%                  | 80.78%                     | 11,412.34                  | 12,389.31                     | 0.03                      | <b>0.03</b>                   |
| 7000        | Cold Storage/Packaging        | 24,958          | 4,608.00            | 85.60%                  | 80.78%                     | 3,944.45                   | 3,722.34                      | 0.16                      | <b>0.15</b>                   |
| 7100        | Transport Terminal            | 13,339          | 464.00              | 86.95%                  | 80.78%                     | 403.45                     | 374.82                        | 0.03                      | <b>0.03</b>                   |
| 7200        | Parking Structure             | 0               | 0.00                |                         | 80.78%                     | 0.00                       | 0.00                          |                           |                               |
| 7300        | Nursery/Daycare               | 101,731         | 4,127.61            | 80.81%                  | 80.78%                     | 3,335.52                   | 3,334.28                      | 0.03                      | <b>0.03</b>                   |
| 7500        | Auto Sales/Service            | 133,144         | 5,256.73            | 81.33%                  | 80.78%                     | 4,275.30                   | 4,246.39                      | 0.03                      | <b>0.03</b>                   |
| 7700        | Exceptional Office            | 0               | 0.00                |                         | 80.78%                     | 0.00                       | 0.00                          |                           |                               |
| 8000        | Light Manufacturing           | 506,540         | 14,292.37           | 82.98%                  | 80.78%                     | 11,859.81                  | 11,545.38                     | 0.02                      | <b>0.02</b>                   |
| 8100        | Heavy Manufacturing           | 13,715          | 936.00              |                         | 80.78%                     | 0.00                       | 756.10                        | 0.00                      | <b>0.06</b>                   |
| 8200        | Distribution Warehouse        | 589,745         | 12,544.00           | 81.00%                  | 80.78%                     | 10,160.64                  | 10,133.04                     | 0.02                      | <b>0.02</b>                   |
| 8300        | Mini Warehouse                | 925,127         | 11,866.82           | 80.20%                  | 80.78%                     | 9,517.19                   | 9,586.02                      | 0.01                      | <b>0.01</b>                   |
| 8400        | Warehouse                     | 2,945,424       | 106,277.70          | 80.84%                  | 80.78%                     | 85,914.89                  | 85,851.13                     | 0.03                      | <b>0.03</b>                   |
| 8500        | Aircraft Hangar               | 0               | 0.00                |                         | 80.78%                     | 0.00                       | 0.00                          |                           |                               |
| 8600        | Barns                         | 52,099          | 2,104.09            | 68.21%                  | 80.78%                     | 1,435.20                   | 1,699.68                      | 0.03                      | <b>0.03</b>                   |
| 8700        | Pre-Fab Metal Building        | 6,942           | 328.00              | 89.75%                  | 80.78%                     | 294.38                     | 264.96                        | 0.04                      | <b>0.04</b>                   |
| 8800        | Technical Manufacturing       | 174,311         | 3,412.00            | 71.06%                  | 80.78%                     | 2,424.57                   | 2,756.21                      | 0.01                      | <b>0.02</b>                   |
| 9000        | School                        | 17,180          | 892.78              | 81.00%                  | 80.78%                     | 723.15                     | 721.19                        | 0.04                      | <b>0.04</b>                   |
| 9100        | Churches                      | 416,285         | 5,638.45            | 69.45%                  | 80.78%                     | 3,915.90                   | 4,554.74                      | 0.01                      | <b>0.01</b>                   |
| 9200        | Educational/Religious         | 510,606         | 16,129.63           | 78.24%                  | 80.78%                     | 12,619.82                  | 13,029.52                     | 0.02                      | <b>0.03</b>                   |
| Total Study |                               | 24,374,266      | 892,680.49          |                         |                            | 586,566.76                 | 583,646.87                    | 0.02                      | <b>0.02</b>                   |

**Notes:**

- (1) Total annual volume adjusted to account for level of service changes.
- (2) Subsequent results based on PA code percent full measure.

**1993 Commercial Generation Study  
Average Pounds per Square Foot**

| PA   | PA Description               | Total<br>Volume<br>per SF<br>Study% | Average<br>Density<br>PA<br>Code | Average<br>Density<br>Total<br>Study | Average<br>Generation<br>per SF<br>PA Density | Average<br>Generation<br>per SF<br>Study Density |
|------|------------------------------|-------------------------------------|----------------------------------|--------------------------------------|---|--|
| 1700 | Dormitory                    | 0.05                                | 154.82                           | 157.94                               | <b>8.10</b>                                   | 8.26   |
| 3400 | Strip Store                  | 0.03                                | 139.45                           | 157.94                               | <b>4.00</b>                                   | 4.53   |
| 3500 | Retail Shop                  | 0.05                                | 156.77                           | 157.94                               | <b>7.47</b>                                   | 7.53   |
| 3600 | Discount Store               | 0.04                                | 116.53                           | 157.94                               | <b>4.92</b>                                   | 6.67   |
| 3700 | Department Store             | 0.02                                | 110.34                           | 157.94                               | <b>1.72</b>                                   | 2.47   |
| 3800 | Neighborhood Shopping Center | 0.04                                | 170.55                           | 157.94                               | <b>6.58</b>                                   | 6.10   |
| 3900 | Community Shopping Center    | 0.02                                | 150.93                           | 157.94                               | <b>3.06</b>                                   | 3.20   |
| 4000 | Shopping Center Regional     | 0.03                                | 228.83                           | 157.94                               | <b>6.20</b>                                   | 4.28   |
| 4100 | Shopping Center Super Region | 0.04                                | 174.36                           | 157.94                               | <b>6.68</b>                                   | 6.05   |
| 4200 | Supermarket                  | 0.09                                | 180.74                           | 157.94                               | <b>16.35</b>                                  | 14.29  |
| 4300 | Convenience Store            | 0.17                                | 122.90                           | 157.94                               | <b>21.33</b>                                  | 27.42  |
| 4400 | Hotel                        | 0.04                                | 207.38                           | 157.94                               | <b>8.18</b>                                   | 6.23   |
| 4500 | Hotel/Motel/Resort           | 0.03                                | 95.61                            | 157.94                               | <b>2.56</b>                                   | 4.22   |
| 4600 | Low Rise Motel               | 0.03                                | 199.97                           | 157.94                               | <b>5.04</b>                                   | 3.98   |
| 4700 | High Rise Motel              | 0.02                                | 135.29                           | 157.94                               | <b>3.27</b>                                   | 3.82   |
| 4900 | Office-Low Rise              | 0.02                                | 117.74                           | 157.94                               | <b>2.76</b>                                   | 3.70   |
| 5000 | Office-High Rise             | 0.01                                | 122.26                           | 157.94                               | <b>1.57</b>                                   | 2.03   |
| 5100 | Office Condo                 |                                     | 118.30                           | 157.94                               |   |  |
| 5200 | Medical Office               | 0.03                                | 114.94                           | 157.94                               | <b>2.97</b>                                   | 4.08   |
| 5300 | Hospital                     | 0.02                                | 159.46                           | 157.94                               | <b>3.62</b>                                   | 3.58   |
| 5301 | Hospitals with Incinerators  | 0.01                                | 172.26                           | 157.94                               | <b>1.32</b>                                   | 1.21   |
| 5400 | Nursing Home                 | 0.02                                | 119.91                           | 157.94                               | <b>2.17</b>                                   | 2.86   |
| 5500 | Bar/Nightclub                | 0.08                                | 154.09                           | 157.94                               | <b>12.37</b>                                  | 12.68  |
| 5600 | Restaurant                   | 0.13                                | 190.97                           | 157.94                               | <b>25.58</b>                                  | 21.15  |
| 5700 | Fast Food Restaurant         | 0.20                                | 202.99                           | 157.94                               | <b>40.03</b>                                  | 31.14  |
| 5800 | Bowling Alley                | 0.02                                | 90.43                            | 157.94                               | <b>2.02</b>                                   | 3.53   |
| 5900 | Arena                        | 0.01                                | 231.71                           | 157.94                               | <b>2.08</b>                                   | 1.41   |
| 6000 | Auditorium                   | 0.02                                | 94.25                            | 157.94                               | <b>1.96</b>                                   | 3.28   |
| 6100 | Theater                      | 0.03                                | 245.00                           | 157.94                               | <b>8.46</b>                                   | 5.46   |
| 6200 | Bank                         | 0.02                                | 81.26                            | 157.94                               | <b>1.33</b>                                   | 2.59   |
| 6300 | Branch Bank                  | 0.04                                | 145.92                           | 157.94                               | <b>6.22</b>                                   | 6.73   |
| 6400 | Service Station              | 0.09                                | 170.66                           | 157.94                               | <b>16.21</b>                                  | 15.00  |
| 6500 | Garage                       | 0.04                                | 176.16                           | 157.94                               | <b>6.61</b>                                   | 5.93   |
| 6600 | Vehicle Sales/Repair         | 0.04                                | 182.24                           | 157.94                               | <b>6.53</b>                                   | 5.66   |
| 6700 | Service Shop                 | 0.04                                | 158.38                           | 157.94                               | <b>6.74</b>                                   | 6.72   |
| 6800 | Mortuary                     | 0.02                                | 114.81                           | 157.94                               | <b>1.90</b>                                   | 2.62   |
| 6900 | Clubhouse                    | 0.03                                | 144.96                           | 157.94                               | <b>4.87</b>                                   | 5.30   |
| 7000 | Cold Storage/Packaging       | 0.15                                | 89.47                            | 157.94                               | <b>13.34</b>                                  | 23.56  |
| 7100 | Transport Terminal           | 0.03                                | 74.53                            | 157.94                               | <b>2.09</b>                                   | 4.44   |
| 7200 | Parking Structure            |                                     |                                  | 157.94                               |   |  |
| 7300 | Nursery/Daycare              | 0.03                                | 171.73                           | 157.94                               | <b>5.63</b>                                   | 5.18   |
| 7500 | Auto Sales/Service           | 0.03                                | 120.76                           | 157.94                               | <b>3.85</b>                                   | 5.04   |
| 7700 | Exceptional Office           |                                     |                                  | 157.94                               |   |  |
| 8000 | Light Manufacturing          | 0.02                                | 200.97                           | 157.94                               | <b>4.58</b>                                   | 3.60   |
| 8100 | Heavy Manufacturing          | 0.06                                | 166.67                           | 157.94                               | <b>9.19</b>                                   | 8.71   |
| 8200 | Distribution Warehouse       | 0.02                                | 131.10                           | 157.94                               | <b>2.25</b>                                   | 2.71   |
| 8300 | Mini Warehouse               | 0.01                                | 176.40                           | 157.94                               | <b>1.83</b>                                   | 1.64   |
| 8400 | Warehouse                    | 0.03                                | 178.28                           | 157.94                               | <b>5.20</b>                                   | 4.60   |
| 8500 | Aircraft Hangar              |                                     |                                  | 157.94                               |   |  |
| 8600 | Barns                        | 0.03                                | 158.55                           | 157.94                               | <b>5.17</b>                                   | 5.15   |
| 8700 | Pre-Fab Metal Building       | 0.04                                | 150.00                           | 157.94                               | <b>5.73</b>                                   | 6.03   |
| 8800 | Technical Manufacturing      | 0.02                                | 140.65                           | 157.94                               | <b>2.22</b>                                   | 2.50   |
| 9000 | School                       | 0.04                                | 182.90                           | 157.94                               | <b>7.68</b>                                   | 6.63   |
| 9100 | Churches                     | 0.01                                | 94.38                            | 157.94                               | <b>1.03</b>                                   | 1.73   |
| 9200 | Educational/Religious        | 0.03                                | 145.23                           | 157.94                               | <b>3.71</b>                                   | 4.03   |

**Notes:**

- (1) Study density equals weighted average density from schedule entitled Weighted Average Solid Waste Density.
- (2) Average generation per square foot using PA code average density used in subsequent calculations.

**1993 Commercial Generation Study  
Category Summary**

| PA Code                                 | 1,994<br>Square<br>Footage | Tested<br>Square<br>Footage | Tested<br>Measured<br>Waste | Category<br>Ratio<br>(Lbs/SF) | Estimated Total<br>Waste Generation<br>(Tons per Year) |
|---|----------------------------|-----------------------------|-----------------------------|-------------------------------|--|
| <b>1700 Dormitory</b>                   | <b>1,546,802</b>           | <b>131,258</b>              | <b>1,063,290.69</b>         | <b>8.10</b>                   | <b>6,265</b>   |
| <b>3400 Strip Store</b>                 | <b>8,561,805</b>           | <b>849,936</b>              | <b>3,399,148.03</b>         | <b>4.00</b>                   | <b>17,121</b>  |
| <b>3500 Retail Shop</b>                 | <b>4,656,096</b>           | <b>399,048</b>              | <b>2,982,874.50</b>         | <b>7.47</b>                   | <b>17,402</b>  |
| <b>3600 Discount Store</b>              | <b>7,054,986</b>           | <b>629,500</b>              | <b>3,096,597.00</b>         | <b>4.92</b>                   | <b>17,352</b>  |
| <b>3700 Department Store</b>            | <b>4,349,126</b>           | <b>2,933,911</b>            | <b>5,056,958.84</b>         | <b>1.72</b>                   | <b>3,748</b>   |
| 3800 Neighborhood Shopping Cer          | 3,805,623                  | 383,026                     | 2,467,396.98                | 6.44                          | 12,258   |
| 3900 Community Shopping Cente           | 3,024,990                  | 132,709                     | 448,617.63                  | 3.38                          | 5,113  |
| 4000 Shopping Center Regional           | 260,413                    | 257,549                     | 1,163,601.99                | 4.52                          | 588  |
| 4100 Shopping Center Super Reg          | 1,851,427                  | 1,068,601                   | 6,834,409.25                | 6.40                          | 5,921  |
| <b>Shopping Centers</b>                 | <b>8,942,453</b>           | <b>1,841,885</b>            | <b>10,914,025.85</b>        | <b>5.34</b>                   | <b>23,879</b>  |
| <b>4200 Supermarket</b>                 | <b>4,134,531</b>           | <b>492,623</b>              | <b>8,052,920.46</b>         | <b>16.35</b>                  | <b>33,794</b>  |
| <b>4300 Convenience Store</b>           | <b>739,287</b>             | <b>92,977</b>               | <b>1,983,590.80</b>         | <b>21.33</b>                  | <b>7,886</b>   |
| 4400 Hotel                              | 499,730                    | 64,803                      | 423,265.61                  | 6.53                          | 1,632  |
| 4500 Hotel/Motel/Resort                 | 1,109,648                  | 873,768                     | 3,871,213.45                | 4.43                          | 2,458  |
| 4600 Low Rise Motel                     | 4,076,367                  | 578,360                     | 2,416,014.70                | 4.18                          | 8,514  |
| 4700 High Rise Motel                    | 3,096,800                  | 277,956                     | 1,113,275.87                | 4.01                          | 6,202  |
| <b>Hotel/Motel/Resort</b>               | <b>8,782,545</b>           | <b>1,794,887</b>            | <b>7,823,769.62</b>         | <b>4.28</b>                   | <b>18,806</b>  |
| 4900 Office-Low Rise                    | 24,334,952                 | 2,839,501                   | 7,859,900.21                | 2.77                          | 33,680   |
| 5000 Office-High Rise                   | 6,186,121                  | 443,768                     | 675,796.74                  | 1.52                          | 4,710  |
| 5100 Office Condo                       | 3,960,661                  | 0                           | 0.00                        | 2.52                          | 4,982  |
| <b>Office</b>                           | <b>34,481,734</b>          | <b>3,283,269</b>            | <b>8,535,696.95</b>         | <b>2.52</b>                   | <b>43,372</b>  |
| <b>5200 Medical Office</b>              | <b>3,000,050</b>           | <b>321,814</b>              | <b>954,872.87</b>           | <b>2.97</b>                   | <b>4,451</b>   |
| <b>5300 Hospital</b>                    | <b>2,084,563</b>           | <b>697,549</b>              | <b>2,524,711.04</b>         | <b>3.62</b>                   | <b>3,772</b>   |
| <b>5301 Hospitals with Incinerators</b> | <b>1,150,848</b>           | <b>1,131,326</b>            | <b>1,488,566.19</b>         | <b>1.32</b>                   | <b>757</b>   |
| <b>5400 Nursing Home</b>                | <b>3,577,707</b>           | <b>716,364</b>              | <b>1,557,163.72</b>         | <b>2.17</b>                   | <b>3,888</b>   |
| <b>5500 Bar/Nightclub</b>               | <b>729,894</b>             | <b>54,930</b>               | <b>679,627.50</b>           | <b>12.37</b>                  | <b>4,515</b>   |
| <b>5600 Restaurant</b>                  | <b>6,452,720</b>           | <b>629,452</b>              | <b>16,098,646.93</b>        | <b>25.58</b>                  | <b>82,516</b>  |
| <b>5700 Fast Food Restaurant</b>        | <b>758,363</b>             | <b>74,134</b>               | <b>2,967,297.43</b>         | <b>40.03</b>                  | <b>15,177</b>  |
| <b>5800 Bowling Alley</b>               | <b>517,402</b>             | <b>248,082</b>              | <b>501,410.77</b>           | <b>2.02</b>                   | <b>523</b>   |
| <b>5900 Arena</b>                       | <b>629,811</b>             | <b>407,944</b>              | <b>846,781.23</b>           | <b>2.08</b>                   | <b>654</b>   |
| <b>6000 Auditorium</b>                  | <b>648,148</b>             | <b>17,082</b>               | <b>33,436.27</b>            | <b>1.96</b>                   | <b>634</b>   |
| <b>6100 Theater</b>                     | <b>745,758</b>             | <b>55,329</b>               | <b>468,257.43</b>           | <b>8.46</b>                   | <b>3,156</b>   |
| <b>6200 Bank</b>                        | <b>989,031</b>             | <b>117,827</b>              | <b>157,015.25</b>           | <b>1.33</b>                   | <b>659</b>   |
| <b>6300 Branch Bank</b>                 | <b>797,407</b>             | <b>78,485</b>               | <b>487,809.31</b>           | <b>6.22</b>                   | <b>2,478</b>   |
| 6400 Service Station                    | 352,529                    | 24,472                      | 396,692.46                  | 16.21                         | 2,857  |
| 7400 Gas Mart                           | 36,987                     | 0                           | 0.00                        | 16.21                         | 300  |
| <b>Automobile Service</b>               | <b>389,516</b>             | <b>24,472</b>               | <b>396,692.46</b>           | <b>16.21</b>                  | <b>3,157</b>   |
| <b>6500 Garage</b>                      | <b>247,977</b>             | <b>22,886</b>               | <b>151,291.27</b>           | <b>6.61</b>                   | <b>820</b>   |
| <b>6600 Vehicle Sales/Repair</b>        | <b>3,660,377</b>           | <b>379,319</b>              | <b>2,477,923.66</b>         | <b>6.53</b>                   | <b>11,956</b>  |
| <b>6700 Service Shop</b>                | <b>1,008,578</b>           | <b>112,231</b>              | <b>756,621.88</b>           | <b>6.74</b>                   | <b>3,400</b>   |
| <b>6800 Mortuary</b>                    | <b>232,410</b>             | <b>35,509</b>               | <b>67,517.28</b>            | <b>1.90</b>                   | <b>221</b>   |
| <b>6900 Clubhouse</b>                   | <b>4,567,293</b>           | <b>369,091</b>              | <b>1,795,954.29</b>         | <b>4.87</b>                   | <b>11,112</b>  |
| <b>7000 Cold Storage/Packaging</b>      | <b>279,384</b>             | <b>24,958</b>               | <b>333,037.97</b>           | <b>13.34</b>                  | <b>1,864</b>   |
| <b>7100 Transport Terminal</b>          | <b>20,866</b>              | <b>13,339</b>               | <b>27,935.27</b>            | <b>2.09</b>                   | <b>22</b>  |
| <b>7200 Parking Structure</b>           | <b>21,000</b>              | <b>0</b>                    | <b>0.00</b>                 | <b>0.30</b>                   | <b>3</b>   |
| <b>7300 Nursery/Daycare</b>             | <b>865,215</b>             | <b>101,731</b>              | <b>572,596.48</b>           | <b>5.63</b>                   | <b>2,435</b>   |
| <b>7500 Auto Sales/Service</b>          | <b>1,428,107</b>           | <b>133,144</b>              | <b>512,793.63</b>           | <b>3.85</b>                   | <b>2,750</b>   |
| <b>7700 Exceptional Office</b>          | <b>0</b>                   | <b>0</b>                    | <b>0.00</b>                 | <b>na</b>                     | <b>0</b>   |
| <b>8000 Light Manufacturing</b>         | <b>5,545,571</b>           | <b>506,540</b>              | <b>2,320,274.31</b>         | <b>4.58</b>                   | <b>12,701</b>  |
| <b>8100 Heavy Manufacturing</b>         | <b>234,580</b>             | <b>13,715</b>               | <b>126,019.32</b>           | <b>1.50</b>                   | <b>176</b>   |
| <b>8200 Distribution Warehouse</b>      | <b>4,030,792</b>           | <b>589,745</b>              | <b>1,328,441.96</b>         | <b>2.25</b>                   | <b>4,540</b>   |
| <b>8300 Mini Warehouse</b>              | <b>3,647,311</b>           | <b>925,127</b>              | <b>1,690,963.34</b>         | <b>1.83</b>                   | <b>3,333</b>   |
| <b>8400 Warehouse</b>                   | <b>24,439,218</b>          | <b>2,945,424</b>            | <b>15,305,538.75</b>        | <b>5.20</b>                   | <b>63,498</b>  |
| <b>8500 Aircraft Hangar</b>             | <b>121,493</b>             | <b>0</b>                    | <b>0.00</b>                 | <b>6.10</b>                   | <b>371</b>   |
| <b>8600 Barns</b>                       | <b>304,336</b>             | <b>52,099</b>               | <b>269,484.88</b>           | <b>5.17</b>                   | <b>787</b>   |
| <b>8700 Pre-Fab Metal Building</b>      | <b>35,368</b>              | <b>6,942</b>                | <b>39,743.76</b>            | <b>5.73</b>                   | <b>101</b>   |
| <b>8800 Technical Manufacturing</b>     | <b>2,463,657</b>           | <b>174,311</b>              | <b>387,661.44</b>           | <b>2.22</b>                   | <b>2,740</b>   |
| <b>9000 School</b>                      | <b>122,542</b>             | <b>17,180</b>               | <b>131,905.23</b>           | <b>7.68</b>                   | <b>470</b>   |
| <b>9100 Churches</b>                    | <b>3,533,614</b>           | <b>416,285</b>              | <b>429,876.35</b>           | <b>1.03</b>                   | <b>1,824</b>   |
| <b>9200 Educational/Religious</b>       | <b>3,987,059</b>           | <b>510,606</b>              | <b>1,892,276.48</b>         | <b>3.71</b>                   | <b>7,388</b>   |
| <b>9201 Museums</b>                     | <b>145,888</b>             | <b>0</b>                    | <b>0.00</b>                 | <b>1.12</b>                   | <b>82</b>  |
| <b>Total</b>                            | <b>166,663,219</b>         | <b>24,374,266</b>           | <b>112,689,019</b>          | <b>5.38</b>                   | <b>448,557</b>   |

**1993 Commercial Generation Study  
Category Ranking**

| PA Code                          | SF         | Rate  | Annual Tons | Totals |            |
|----------------------------------|------------|-------|-------------|--------|------------|
| 7200 Parking Structure           | 21,000     | 0.30  | 3.15        |        |            |
| 9100 Churches                    | 3,533,614  | 1.03  | 1,824.49    |        |            |
| 9201 Museums                     | 145,888    | 1.12  | 83.16       |        |            |
| 5301 Hospitals with Incinerators | 1,150,848  | 1.32  | 757.13      |        |            |
| 6200 Bank                        | 989,031    | 1.33  | 658.99      | T      | 11,439.58  |
| 8100 Heavy Manufacturing         | 234,580    | 1.50  | 175.94      | %      | 2.55%      |
| 3700 Department Store            | 4,349,126  | 1.72  | 3,748.13    | R      | 1.53       |
| 8300 Mini Warehouse              | 3,647,311  | 1.83  | 3,333.31    |        |            |
| 6800 Mortuary                    | 232,410    | 1.90  | 220.95      |        |            |
| 6000 Auditorium                  | 648,148    | 1.96  | 634.34      |        |            |
| 5800 Bowling Alley               | 517,402    | 2.02  | 522.87      |        |            |
| 5900 Arena                       | 629,811    | 2.08  | 653.66      |        |            |
| 7100 Transport Terminal          | 20,866     | 2.09  | 21.85       |        |            |
| 5400 Nursing Home                | 3,577,707  | 2.17  | 3,888.44    |        |            |
| 8800 Technical Manufacturing     | 2,463,657  | 2.22  | 2,739.54    |        |            |
| 8200 Distribution Warehouse      | 4,030,792  | 2.25  | 4,539.82    |        |            |
| Office                           | 34,481,734 | 2.52  | 43,372.43   |        |            |
| 5200 Medical Office              | 3,000,050  | 2.97  | 4,450.81    |        |            |
| 5300 Hospital                    | 2,084,563  | 3.62  | 3,772.44    |        |            |
| 9200 Educational/Religious       | 3,987,059  | 3.71  | 7,387.91    |        |            |
| 7500 Auto Sales/Service          | 1,428,107  | 3.85  | 2,750.12    |        |            |
| 3400 Strip Store                 | 8,561,805  | 4.00  | 17,120.61   |        |            |
| Hotel/Motel/Resort               | 8,782,545  | 4.28  | 18,806.05   | T      | 288,209.47 |
| 8000 Light Manufacturing         | 5,545,571  | 4.58  | 12,701.12   | %      | 64.25%     |
| 6900 Clubhouse                   | 4,567,293  | 4.87  | 11,111.96   | R      | 4.17       |
| 3600 Discount Store              | 7,054,986  | 4.92  | 17,352.22   |        |            |
| 8600 Barns                       | 304,336    | 5.17  | 787.10      |        |            |
| 8400 Warehouse                   | 24,439,218 | 5.20  | 63,497.72   |        |            |
| Shopping Centers                 | 8,942,453  | 5.34  | 23,879.38   |        |            |
| 7300 Nursery/Daycare             | 865,215    | 5.63  | 2,434.95    |        |            |
| 8700 Pre-Fab Metal Building      | 35,368     | 5.73  | 101.24      |        |            |
| 8500 Aircraft Hangar             | 121,493    | 6.10  | 370.55      |        |            |
| 6300 Branch Bank                 | 797,407    | 6.22  | 2,478.07    |        |            |
| 6600 Vehicle Sales/Repair        | 3,660,377  | 6.53  | 11,955.81   |        |            |
| 6500 Garage                      | 247,977    | 6.61  | 819.64      |        |            |
| 6700 Service Shop                | 1,008,578  | 6.74  | 3,399.74    |        |            |
| 3500 Retail Shop                 | 4,656,096  | 7.47  | 17,402.10   |        |            |
| 9000 School                      | 122,542    | 7.68  | 470.43      |        |            |
| 1700 Dormitory                   | 1,546,802  | 8.10  | 6,265.14    |        |            |
| 6100 Theater                     | 745,758    | 8.46  | 3,155.73    |        |            |
| 5500 Bar/Nightclub               | 729,894    | 12.37 | 4,515.35    |        |            |
| 7000 Cold Storage/Packaging      | 279,384    | 13.34 | 1,864.04    |        |            |
| Automobile Service               | 389,516    | 16.21 | 3,157.04    | T      | 148,909.56 |
| 4200 Supermarket                 | 4,134,531  | 16.35 | 33,793.64   | %      | 33.20%     |
| 4300 Convenience Store           | 739,287    | 21.33 | 7,886.05    | R      | 22.09      |
| 5600 Restaurant                  | 6,452,720  | 25.58 | 82,516.27   |        |            |
| 5700 Fast Food Restaurant        | 758,363    | 40.03 | 15,177.17   |        |            |

The generation rates of the majority of businesses are actually higher or lower than their classification average, which in many cases, places their generation above or below the average generation rates of business classifications ranked higher or lower, respectively, than the classification they are in. In other words, if the generation rates of individual business were plotted along a waste generation rate continuum, with a different color for each business classification, one would see a considerable amount of overlap across classifications.

As with any attempt to group multiple categories into broader classes, subjective factors come into play. Due to the nature of averages, unavoidably, businesses whose calculated generation falls at the bottom of a class range will be billed based on an average rate that exceeds their calculated generation, while businesses whose calculated generation falls at the top of the range will be billed based on a lower average generation rate. Not differentiating between the business classifications above and below a significant break in the data would provide a windfall to those above the break in the form of an annual assessment significantly lower than their generation suggests, and just the opposite for those business classifications below the break.

The first step was to identify significant breaking points in the data. Two breaking points were identified between PA code 6100 (8.46 Lbs/SF) and PA code 5500 (12.37 Lbs/SF) and between PA codes 5600 (25.58 Lbs/SF) and 5700 (40.03 Lbs/SF). These two breaking points potentially define two upper categories. The first boundary, at just above 12 pounds per square foot, is in roughly the same position as was recommended in the previous study. The large difference between the restaurant and fast food restaurant categories, which was not so significant in the prior study, appears to indicate the potential for the addition of another generator grouping, although this is not recommended.

First, placing a break between restaurants and fast food restaurants would create a category with only one business classification, which fails to recognize the natural variations within the classification discussed above. Further, even though the break is significant, the square footage in the fast food restaurant category is very low and the rate impact on the other high generators resulting from the inclusion of fast food restaurants with the other high generators is very small.

Coincidentally, all of the business classifications above the proposed boundary at 12 pounds per square foot are currently ranked in the high generator category based on the DUS study. Two classifications currently in the high category, transport terminals and aircraft hangars, are not in the high category based on this study.

Although relatively large breaks in the data can be seen at the high generation levels, no real discernible breaks can be seen in the balance of the data, which ranges from .30 pounds per square foot to 8.46 pounds per square foot. For this reason, although adding an additional category to further differentiate the classifications in this range was considered, the idea was ultimately abandoned.

Based on the results of the previous study, the boundary for the low generator category was placed at 2.00 pounds per square foot. Because there is no steadfast mathematical means to calculate where the break point should be and because the study results do not indicate any reason for a change, the low generator category is presented consisting of all classifications with average generation rates less than or equal to 2.00 pounds per square foot.

Also coincidentally, all of the business classifications previously classified as low generators are low generators based on this study. As a result of decreased generation rates, banks, department stores, mini warehouses, mortuaries, and auditoriums have moved into the low generator category. Additionally, due to

increased differentiation, hospitals with incinerators have moved into the low generator category, while other hospitals remain in the medium category.

### **3.6 Changes from Previous Study Results**

A comparison of the results from this study to those from the previous commercial generation study is presented on [Page 32](#). Of the 47 commercial categories for which a comparison can be made, the estimated average generation rate decreased for 42 and increased for 5. Some of the decreases can be attributed to the increase in commercial recycling, as many commercial entities are diverting recyclable materials toward recycling markets and out of the municipal solid waste stream.

The largest decreases occurred in department stores and transport terminals. The calculated average generation rate for department stores decreased from 13.52 to 1.72 pounds per square foot and from 146% to 27% of the mean generation rate. The generation rate for transport terminals decreased from 46.34 to 2.09 pounds per square foot and from 501% of the mean generation rate to 33% of the mean generation rate, largely as a result of the transfer of the higher generators to the agricultural classification. The most significant increase occurred in the fast food restaurant category. The calculated average generation rate increased from 23.76 pounds per square foot to 40.03 pounds per square foot and from 257% to 633% of the mean generation rate.

For the entire study, the average generation rate decreased from 6.60 to 5.38 pounds per square foot, a decrease of 18%. Although this is a considerable decline, the aggregate generation predicted by the study still appears to be higher than the amount of commercial waste the Authority receives, although the difference is significantly lower. The reason for the discrepancy is unknown, although loss of material across the border is a possibility. The estimated commercial generation from this study is 448,557 tons, versus 549,296 tons in the original study, based on approximately equivalent square footage.

The estimated quantity of solid waste generated by high generators as a percent of total commercial generation has increased from approximately 24% in the original study to 33% in the 1993 study. The total estimated quantity of solid waste from the high generator category is 148,910 tons, versus 133,521 tons in the original study, an increase of 12%. This increase coupled with a decrease of 28% in the estimated solid waste generation from the low and medium generator categories caused the shift in the relative generation toward the high generator category. The force behind this shift is a 13% increase in the average generation rate for the high generator category from 19.53 to 22.09 pounds per square foot, versus a 28% decrease in the average generation rate for the combined low and medium generator categories from 5.44 to 3.91 pounds per square foot.

The increase in the average generation rate for the high category is the result of two factors. First, the restaurant square footage increased from 1,972,517 to 6,452,720 due to an increase in restaurant space and the break-out and transfer of embedded restaurant space, the impact of which has already been reflected in the rates. Second, the increase in the average generation rate for fast food restaurants increased the average generation rate by 1.36 pounds per square foot. In the absence of these two events, the average generation rate for the high generator category would be 18.99 pounds per square foot.



## **4.0 Summary and Concluding Comments**

This report presented the results of the 1993 Commercial Generation Study, the category ranking, and the three categories of commercial classifications to be used in the assessment billing program. The following comments relate to significant findings.

The results of this study validate the conclusions of DUS consultants in the original study regarding the variability of generation rates within business classifications and the continuing need for a variable component in the commercial billing program.

The average solid waste density calculated during the study was 158 pounds per cubic yard. When adjusted for empty container volume, the average calculated solid waste density was 134 pounds per cubic yard, which coincidentally, is the same as was calculated in the original study.

Due to the difficulty in gathering the data necessary to calculate density, it has been suggested that the process could be speeded up significantly if the waste densities were calculated by weighing the container full using a scale equipped front-end loader collection vehicle, tipping the waste, and weighing the container empty, thus eliminating the need to visit each business twice. Given the fact that the net weight of the total waste measured to calculate density was 243 tons and that the tipping fees would have totalled only \$9,720 using the Authority's current tipping fee, this approach is recommended for future studies.

Finally, I would like to thank the Solid Waste Authority Customer Information Services personnel involved in the study for their hard work in collecting all of the data necessary to complete the study. I would especially like to thank Lynn Bestul for the excellent manner in which he coordinated the data collection activities.

**1993 Commercial Generation Study  
Comparison to Previous Study Results**

|                                     | DUS   | Ratio to<br>Average | New   | Ratio to<br>Average | Difference | Percent<br>Difference |
|-------------------------------------|-------|---------------------|-------|---------------------|------------|-----------------------|
| 1700 Dormitory                      | 9.37  | 101.21%             | 8.10  | 128.13%             | (1.27)     | -13.52%               |
| 3400 Strip Store                    |       |                     | 4.00  | 63.27%              |            |                       |
| 3500 Retail Shop                    | 9.35  | 101.06%             | 7.47  | 118.16%             | (1.88)     | -20.13%               |
| 3600 Discount Store                 | 6.18  | 66.81%              | 4.92  | 77.83%              | (1.26)     | -20.43%               |
| 3700 Department Store               | 13.52 | 146.11%             | 1.72  | 27.21%              | (11.80)    | -87.28%               |
| 3800 Neighborhood Shopping Center   | 7.69  | 83.10%              | 5.34  | 84.47%              | (2.35)     | -30.56%               |
| 3900 Community Shopping Center      | 7.69  | 83.10%              | 5.34  | 84.47%              | (2.35)     | -30.56%               |
| 4000 Shopping Center Regional       | 7.69  | 83.10%              | 5.34  | 84.47%              | (2.35)     | -30.56%               |
| 4100 Shopping Center Super Regional | 9.58  | 103.49%             | 5.34  | 84.47%              | (4.24)     | -44.24%               |
| 4200 Supermarket                    | 16.55 | 178.83%             | 16.35 | 258.63%             | (0.20)     | -1.20%                |
| 4300 Convenience Store              | 35.11 | 379.42%             | 21.33 | 337.41%             | (13.78)    | -39.25%               |
| 4400 Hotel                          | 5.15  | 55.70%              | 4.28  | 67.70%              | (0.87)     | -16.97%               |
| 4500 Hotel/Motel/Resort             | 5.15  | 55.70%              | 4.28  | 67.70%              | (0.87)     | -16.97%               |
| 4600 Low Rise Motel                 | 5.15  | 55.70%              | 4.28  | 67.70%              | (0.87)     | -16.97%               |
| 4700 High Rise Motel                | 5.15  | 55.70%              | 4.28  | 67.70%              | (0.87)     | -16.97%               |
| 4800 Office-Low Rise                | 3.85  | 41.55%              | 2.52  | 39.86%              | (1.33)     | -34.46%               |
| 4900 Office-High Rise               | 3.85  | 41.55%              | 2.52  | 39.86%              | (1.33)     | -34.46%               |
| 5100 Office Condo                   | 3.85  | 41.55%              | 2.52  | 39.86%              | (1.33)     | -34.46%               |
| 5200 Medical Office                 | 4.76  | 51.44%              | 2.97  | 46.98%              | (1.79)     | -37.61%               |
| 5300 Hospital                       | 3.10  | 33.48%              | 3.62  | 57.26%              | 0.52       | 16.83%                |
| 5301 Hospital with Incinerator      |       |                     | 1.32  | 20.88%              |            |                       |
| 5400 Nursing Home                   | 6.82  | 73.66%              | 2.17  | 34.33%              | (4.65)     | -68.17%               |
| 5500 Bar/Nightclub                  | 15.25 | 164.83%             | 12.37 | 195.67%             | (2.88)     | -18.90%               |
| 5600 Restaurant                     | 25.58 | 276.38%             | 25.58 | 404.64%             | 0.00       | 0.01%                 |
| 5700 Fast Food Restaurant           | 23.76 | 256.75%             | 40.03 | 633.21%             | 16.27      | 68.47%                |
| 5800 Bowling Alley                  | 4.49  | 48.55%              | 2.02  | 31.95%              | (2.47)     | -55.04%               |
| 5900 Arena                          | 3.63  | 39.27%              | 2.08  | 32.90%              | (1.55)     | -42.76%               |
| 6000 Auditorium                     | 8.46  | 91.47%              | 1.96  | 31.00%              | (6.50)     | -76.85%               |
| 6100 Theater                        | 13.46 | 145.50%             | 8.46  | 133.82%             | (5.00)     | -37.17%               |
| 6200 Bank                           | 3.93  | 42.46%              | 1.33  | 21.04%              | (2.60)     | -66.15%               |
| 6300 Branch Bank                    | 7.58  | 81.88%              | 6.22  | 98.39%              | (1.36)     | -17.91%               |
| 6400 Service Station                | 27.34 | 295.41%             | 16.21 | 256.42%             | (11.13)    | -40.71%               |
| 6500 Garage                         | 9.89  | 106.84%             | 6.61  | 104.56%             | (3.28)     | -33.15%               |
| 6600 Vehicle Sales/Repair           | 8.38  | 90.56%              | 6.53  | 103.29%             | (1.85)     | -22.08%               |
| 6700 Service Shop                   | 10.52 | 113.69%             | 6.74  | 106.62%             | (3.78)     | -35.94%               |
| 6800 Mortuary                       | 2.99  | 32.26%              | 1.90  | 30.06%              | (1.09)     | -36.37%               |
| 6900 Clubhouse                      | 7.49  | 80.97%              | 4.87  | 77.04%              | (2.62)     | -35.01%               |
| 7000 Cold Storage/Packaging         | 12.31 | 133.02%             | 13.34 | 211.02%             | 1.03       | 8.37%                 |
| 7100 Transport Terminal             | 46.34 | 500.72%             | 2.09  | 33.06%              | (44.25)    | -95.49%               |
| 7200 Parking Structure              | 0.35  | 3.80%               |       |                     |            |                       |
| 7300 Nursery/Daycare                |       |                     | 5.63  | 89.06%              |            |                       |
| 7500 Auto Sales/Service             | 8.38  | 90.56%              | 3.85  | 60.90%              | (4.53)     | -54.06%               |
| 7700 Exceptional Office             | 3.85  | 41.55%              |       |                     |            |                       |
| 8000 Light Manufacturing            | 4.80  | 51.90%              | 4.58  | 72.45%              | (0.22)     | -4.64%                |
| 8100 Heavy Manufacturing            | 2.08  | 22.52%              | 1.50  | 23.73%              |            |                       |
| 8200 Distribution Warehouse         | 5.69  | 61.49%              | 2.25  | 35.59%              | (3.44)     | -60.46%               |
| 8300 Mini Warehouse                 | 2.51  | 27.09%              | 1.83  | 28.95%              | (0.68)     | -27.01%               |
| 8400 Warehouse                      | 5.69  | 61.49%              | 5.20  | 82.26%              | (0.49)     | -8.61%                |
| 8500 Aircraft Hangar                | 8.63  | 93.29%              |       |                     |            |                       |
| 8600 Barns                          | 12.97 | 140.17%             | 5.17  | 81.78%              | (7.80)     | -60.14%               |
| 8700 Pre-Fab Metal Building         |       |                     | 5.73  | 90.64%              |            |                       |
| 8800 Technical Manufacturing        | 4.80  | 51.90%              | 2.22  | 35.12%              | (2.58)     | -53.78%               |
| 9000 School                         | 5.61  | 60.57%              | 7.68  | 121.49%             | 2.07       | 37.01%                |
| 9100 Churches                       | 1.70  | 18.42%              | 1.03  | 16.29%              | (0.67)     | -39.56%               |
| 9200 Educational/Religious          | 3.93  | 42.46%              | 3.71  | 58.69%              | (0.22)     | -5.59%                |
| 9201 Museums                        |       |                     | 1.12  | 17.72%              |            |                       |
| Mean                                | 9.25  |                     | 6.32  |                     |            |                       |